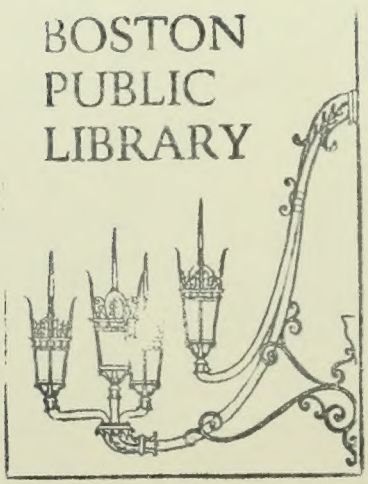
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"JAMESTOWN PLACE"
Bldg. 39 Charlestown Navy Shipyard

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1.0 Architectural Narrative Design Development Concept

DONNELLY
MAUGEL
ARCHITECTS

PAUL J. DONNELLY AIA, PE
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1.0 Architectural Narrative Design Development Concept

Jamestown Place is situated on Parcel 39A at the corner of Second Avenue and Ninth Street at the Charlestown Navy Yard. The building design will reestablish the corner of one of the rectangular blocks that make up the grid pattern of the Navy Yard's master plan. The building will also participate in the development of the Second Avenue pedestrian spine which runs from west to east on the site. The building is rectangular in plan and is symmetrical about its long axis and asymmetrical about its short axis.

Jamestown Place is comprised of seven floors, an attic and a penthouse consisting of 99,800 square feet. The main body of the building is rectangular and has a large hipped roof. This is a simple massing strategy and is derived directly from the industrial building types at the Navy Yard. The high hipped roof is topped with an octagonal cupola. The geometry of the cupola reflects the octagonal shape of the Muster House at the present entrance to the Navy Yard. The intent of this vertical topping is to create a landmark feature given the height and mass of the building.

The facades are generated from the several influential forces. The cornice at the base of the building corresponds directly to the cornice of Building 39, its immediate neighbor. The high arched windows and entrance openings at the base are derived directly from the arched masonary openings in Building 105. The sill line of the second floor windows align with the low cornice of Building 39.

The base material is generally granite which matches the facade material of Building 39. The low cornice and third floor window lintels are precast concrete. The main body of the facade is comprised of brick masonry and is derived directly for its neighbors. The window surrounds are precast concrete.

The fenestration of the main body of the building is comprised of windows with a vertical order. The vertically organized windows are identical in proportion to the windows of Building 39 and are typical of the windows at the Navy Yard.

Over the last month we have focused on the comments presented to us at the schematic design presentation on December 22, 1988.

As the comments relate to the roof geometry, we have eliminated all roof overhangs and have simplified the overall geometry of the roof by eliminating the cruciform shaped hipped roof. The present roof is a rectangular hip over the whole building mass. This roof is then topped with a simple octagonal cupola.

With regard to building fenestration, fewer window types have been utilized throughout in the interest of simplifying the

overall reading of the building. A vertically organized window module is used in the main body of the building to reflect the typically vertical windows at the Yard.

Also, the First Avenue vehicular access has been adjusted to insure safe pedestrian passage along First Avenue.

This design attempts to respond to the schematic design critique and the historic context of the Navy Yard. It is our intention to develop a building that is an integral and compatible addition to the Navy Yard's urban system.

2.0 Structural Design Concept Narrative

2.0 Structural Design Concept Narrative

Jamestown Place consists of a seven story office tower, an attic and penthouse with a three level subgrade parking garage. A steel frame structure with exterior moment frames and an interior braced core has been selected for the structural system of the building. This system allows for flexibility in floor layouts and requires a relatively short time frame for erection.

Structural design for Jamestown Place is being performed in accordance with the requirements of the Commonwealth of Massachusetts State Building Code. Floor live loads are based on office building use for floors two through nine, retail use at grade level, and passenger car parking use on the subgrade levels. Roof snow load is based on Massachusetts Zone 2. Wind loads are based on Massachusetts Zone 3, Exposure C due to the proximity of the site to the open water of Boston Harbor.

Based on the recommendations of Haley and Aldrich (see P2 - Section 2), the foundation system consists of a perimeter slurry wall and interior column spread footings. Columns on the east, north and west exterior walls of the building are supported directly on the top of the slurry wall. Lateral soil, hydrostatic and earthquake loads on the slurry wall are resisted by a tieback and internal bracing system during construction and by the subgrade garage slab and associated framing system for the permanent condition. The lowest level floor slab is a six inch concrete slab reinforced with welded wire fabric over an underslab drainage system to relief hydro static loads.

Wind and earthquake loads on the above grade portion of the structure are taken by a dual bracing system consisting of a moment frame on each of the four exterior column rows and a two-way braced tower at the elevator core. A dual bracing system results in lower earthquake loads on the structure due to the ductility of the moment frame components of the bracing system. Lateral loads at each floor level are distributed to the vertical bracing system through the diaphragm action of the concrete floor slabs. Above grade lateral loads are transferred to the slurry wall foundation at grade elevation by the ground floor slab.

Office and retail floors consist of a 3-1/2" lightweight concrete slab on 1" corrugated steel deck which is supported by wide flange steel framing. Wide flange steel framing was selected over bar joist framing in order to provide a better overall stiffness to the floor system.

Garage floors in flat parking areas are 8" hollow core precast, prestressed deck with a 2" concrete topping. Parking ramps and core areas are 5" cast-in-place concrete slabs. Subgrade parking levels are supported by steel columns and beams which are pocketed into the slurry wall at the perimeter. Transfer of lateral loads from the slurry walls at the ramp to the main parking levels is accomplished through an internal bracing system at the elevator and service core.

Exterior wall panels are supported at each floor level by relieving angles connected to the perimeter floor framing beams. Lateral loads on the exterior wall panels are taken out at each floor level by the concrete slab on deck.

Design drawings contained in P3 Section 2 illustrate our structural design concept.

3.0 Building Environmental System Descriptions

3.0 Building Environmental System Descriptions

3.1 Heating Ventilation and Air Conditioning System (H.V.A.C.)

Jamestown Place will employ a water source heat pump system to satisfy the heating and cooling requirements of the building.

The major components of the water source heat pump system for this project consist of:

- Ten boiler modules at 403.5 MBH net IBR rating
- Two high pressure base mounted circulation pumps
- Combination ceiling concealed heat pump units and vertical closet type heat pump units
- Closed circuit cooling tower roof mounted with a rating of 725 G.P.M.

A piping distribution system will carry either heat from the boiler through the heat pumps to the space or cooling from the cooling tower through the heat pumps to the space. This is all predicated upon sensing the loop water temperature. When the loop water temperature falls to approximately 63F, the boilers stage on and the loop water will be heated to about 70F. The boilers can be staged in any sequence to obtain equal life expectancy. When the loop water temperature rises to approximately 90F, the cooling tower rejects the excess heat in the loop to the atmosphere. This is done in sequence by opening the dampers, starting the spray pump, and starting the unit fans.

By utilizing this system, each tenant's energy consumption (electrical usage) can be measured utilizing hour meters.

Due to the low operating water temperature in the loop, lightweight steel piping with grooved coupling fittings may be used. This piping will not require insulation.

Air will be distributed from the heat pumps through galvanized or aluminum ductwork. The terminal devices will be supply air diffusers connected to the ductwork with insulated flexible ducts.

Return air will be accomplished through a series of egg crate grilles or return air light troffers located throughout in the ceiling grids. The ceiling will be used as a return air plenum so return air ductwork will not be required. All heat pump ductwork will be acoustically lined to reduce system noise.

The main building ventilation will consist to two 10,000 CFM, 7 1/2 HP heating and ventilating units supplying tempered air, by means of hot water coils. One unit will heat 100% outside air from 9F to 60F, 60 GPM and discharge it into the return air plenum. This system will provide ventilation for people sized for approximately 10 CFM per person. The other unit will heat the outside air from 9F to 75F, 17 GPM and discharge it into the corridors. This unit will provide corridor ventilation and smoke exhaust for the building. This system will be sized at 1 CFM/square foot

and will recirculate 75% room air and introduce 25% outside air.

The smoke exhaust system will become energized when a corridor smoke detector senses smoke. The effected floor will only exhaust and floors above and below will only supply. This sequencing confines the smoke to one floor.

There will be a central toilet exhaust system. It will consist of a 2560 CMF, 1 1/2 HP roof fan with ductwork and registers connected to each toilet room.

The building design will conform to the Massachusetts State Building Code under high rise building requirements.

Building smoke exhause will be provided from an 8200 CMF, 5 HP roof fan. This fan will be connected to the make-up air system as previously described.

Stairwells will be pressurized. Pressurization will be provided from a 1 1/2 HP supply air fan at the lower most level and a relief damper at the uppermost portion of the stair. The pressurization will be 0.05 inches of water. A smoke detector located at the top of the stair will activate the supply fan upon sensing smoke.

All systems relating to smoke evacuation or smoke control will be controlled from the fire alarm station. The control mechanism can be either manually operated (by the fire department) or be fully automatic.

Water source heat pump systems supply air to spaces as described from ceiling diffusers. Window downdrafts could present some nuisance type problems to personnel working close to outside walls, in areas where there is high glass. Finned tube radiation will be provided in these areas under glass and be interlocked with the heat pump control system so that heating and cooling do not function simultaneously.

3.2 Electrical Power and Distribution System

Primary power will be provided by Boston Edison Company. Cygna will design electrical areas to accomodate Edison's 13.8 KV transformer and associated switch gear, having sufficient capacity to meet the required loads of the Project. 480 volt secondary power will be provided from the transformer secondary to main breaker equipment.

Tenant power of 480 volt three phase, four wire will be provided from the main electrical room to all nine floors by means of an enclosed Bus Duct System.

Master metering will be provided in the main electrical room planned to be located on level 1 of the garage. In additon, provisions for individual tenant metering centers with 480 to 208/120 volt transformers will be designed on each floor.

H.V.A.C., plumbing, fire protection and alarm system will be provided power.

The estimated connected electrical loads for the project are as follows:

Load Analysis

Area	Sq.Ft.	Watts/Sq.Ft.	Power (KW)
Garage 3 Levels	50,000	2	100
1st Fl. Retail/Commercial	14,000	15	210
2nd Fl. Commercial	13,505	12	162.06
3rd Fl. Commercial	14,415	12	172.98
4th Fl. Commercial	14,415	12	172.98
5th Fl. Commercial	14,415	12	172.98
6th Fl. Commercial	12,320	12	147.84
7th Fl. Commercial	9,150	12	109.80
8th Fl. Commercial	6,640	12	79.68
9th Fl. Commercial	665	11	7.98
	Total Estimated Power		1336.3

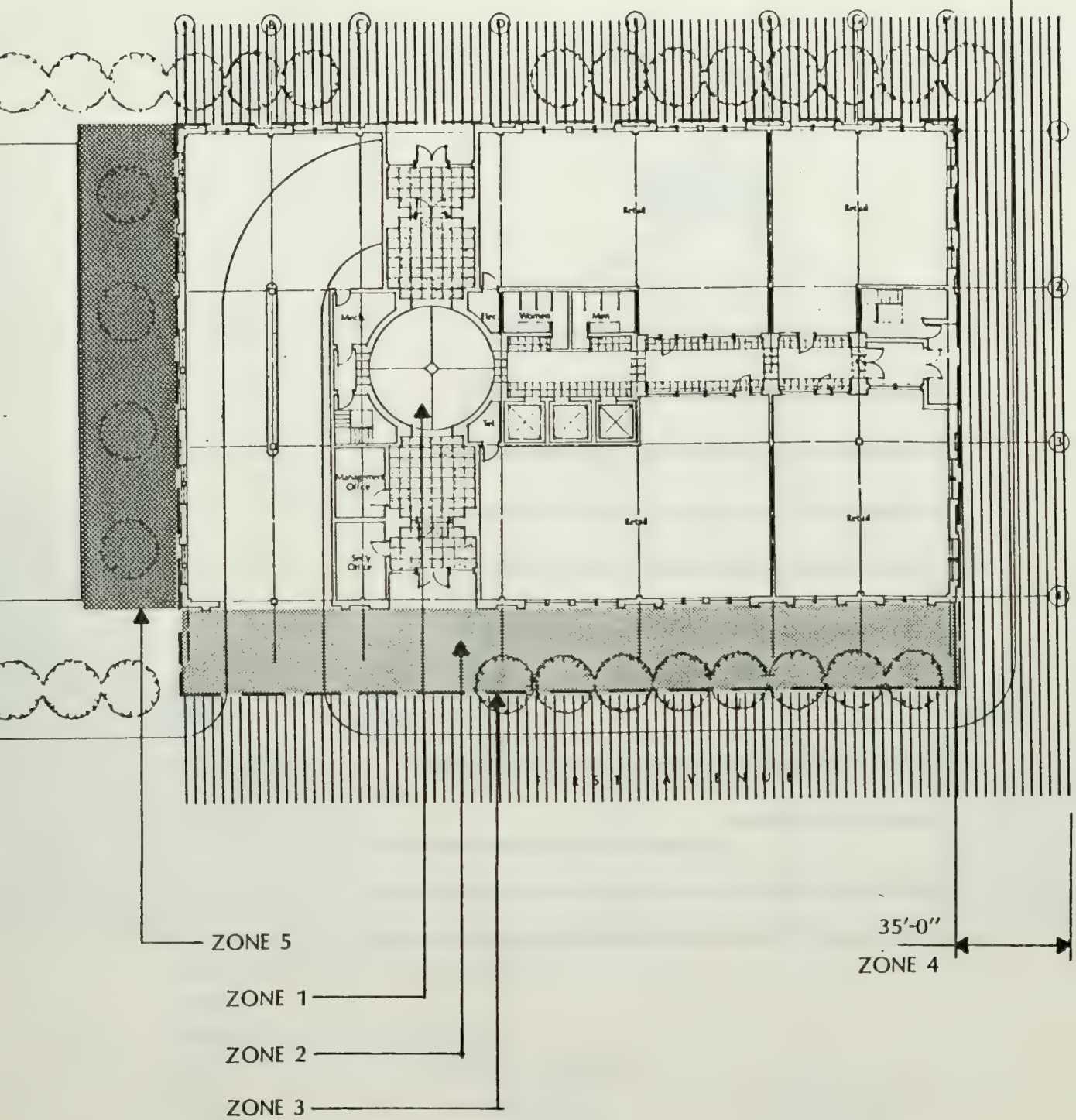
I @ 480V, 3-phase = 1607.36
Continuous Service X 1.25 = 2009.20

Emergency Power

Elevator	25 HP
Fire Pump	75 HP
Smoke Exhaust	50 HP
Emergency Lights	20 KW
Fire Alarm	5 KW

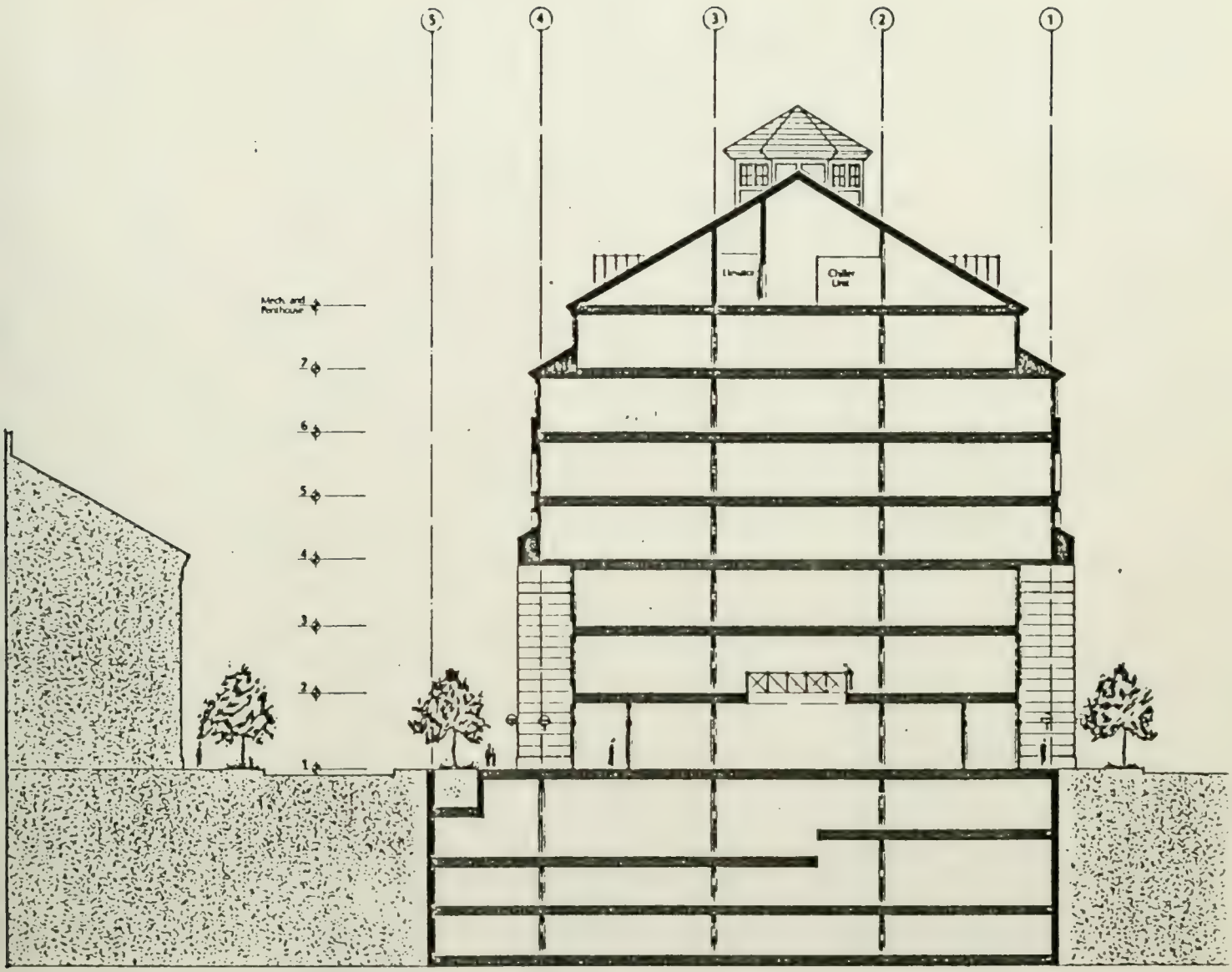
Preliminary Sizing 275 KW Diesel Generator

4.0 Project Statistics



ZONE	DESCRIPTION	TOTAL SQUARE FEET
1	Area under Office Building	14,060
2	Area under First Ave sidewalk (Extended Garage/3 Levels)	9,270
3	Total Area to be excavated	17,095
4	Foundation Tie-Back System	17,150
5	Buffer Zone at Building 39	1,887

GROSS AREA CALCULATION



COMMERCIAL OFFICE BUILDING

FLOOR

COMMERCIAL OFFICE BUILDING

FLOOR	GROSS SQUARE FEET	USE
First	10,610 SF	Retail/Commercial
Second	13,665 SF	Commercial
Third	13,725 SF	Commercial
Fourth	14,060 SF	Commercial
Fifth	14,060 SF	Commercial
Sixth	14,060 SF	Commercial
Seventh	10,820 SF	Commercial
Eighth/Penthouse	8,800 SF	Commercial
TOAL	99,800 SF	

PARKING GARAGE		
Level One	17,150 SF	33 Spaces
Level Two	17,150 SF	33 Spaces
Level Three	17,150 SF	33 Spaces
TOTAL	51,450 SF	99 Spaces

CONCEPT AREA CALCULATION

5.0 Project Milestone Schedule

MILESTONE SCHEDULE

TASK	DATE	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR
SCHEMATIC DES. PHASE																	
SCHEMATIC DESIGN SUBMITTED[1]	12/15 88																
SCHEMATIC DESIGN APPROVED	12/30 88																
DESIGN DEVELOPMENT PHASE																	
DESIGN DEVELOPMENT SUBMITTED[1]	1/27 89																
DESIGN DEVELOPMENT APPROVED	2/10 89																
CONSTRUCTION DOCUMENT PHASE																	
CONSTRUCT. DOCUMENTS SUBMITTED[2]	3/17 89																
CONSTRUCT. DOCUMENTS APPROVED	3/24 89																
CONSTRUCTION CONTRACT AWARDED	4/21 89																
CONSTRUCTION START	5/15 89																
FOUNDATION CONSTRUCT.																	
FOUNDATION CONSTRUCT. COMPLETE	8/18 89																
TOWER CONSTRUCTION																	
TOWER CONSTRUCTION COMPLETE	2/90																
CONSTRUCTION COMPLETE	3/90																

[1] Design Work Continues During Each Approval Process

[2] Construction Documents Out To Bid At This Time

1.0 Final Transportation Impact Overview Report

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um BRA / 548 / part P2 / Tab 1

pn

cn Hmm Associates, Inc.

cn CYGNA Consulting Engineers

il Transportation Data Yard

ti

es, 26 p + Appendices, figures, Tables, maps

at 19890000

os ... sets forth Transportation related impacts (Transit, pedestrian, garage access, Traffic volumes, parking, loading & Taxi, etc) & mitigation measures of a proposed ~~development~~ office & retail development project in Boston's Charlestown Navy Shipyard...

ub

ub

ub Charlestown Navy Shipyard, Boston, MA - Development Projects - Impact

ub Development Projects - MA - Charlestown Naval Shipyard - Impact

ub Parcel 39A, Charlestown, Boston, MA

ub

ub Transportation → MA - Boston - Charlestown Naval Base - Impact

ub

ub

ub

ataloged by date

TRANSPORTATION IMPACT OVERVIEW FOR THE DEVELOPMENT OF PARCEL 39A IN THE CHARLESTOWN NAVY YARD

HMM Document No. 3020/TRAN/967

January 25, 1989

Prepared for:

CYGNA CONSULTING ENGINEERS
286 Congress Street
Boston, MA 02210

Prepared by:

HMM ASSOCIATES, INC.
336 Baker Avenue
Concord, Massachusetts 01742

TRANSPORTATION IMPACT OVERVIEW

for the

DEVELOPMENT OF PARCEL 39A IN THE CHARLESTOWN NAVY YARD

Prepared by

HMM ASSOCIATES, INC.

ENGINEERS, ENVIRONMENTAL CONSULTANTS & PLANNERS

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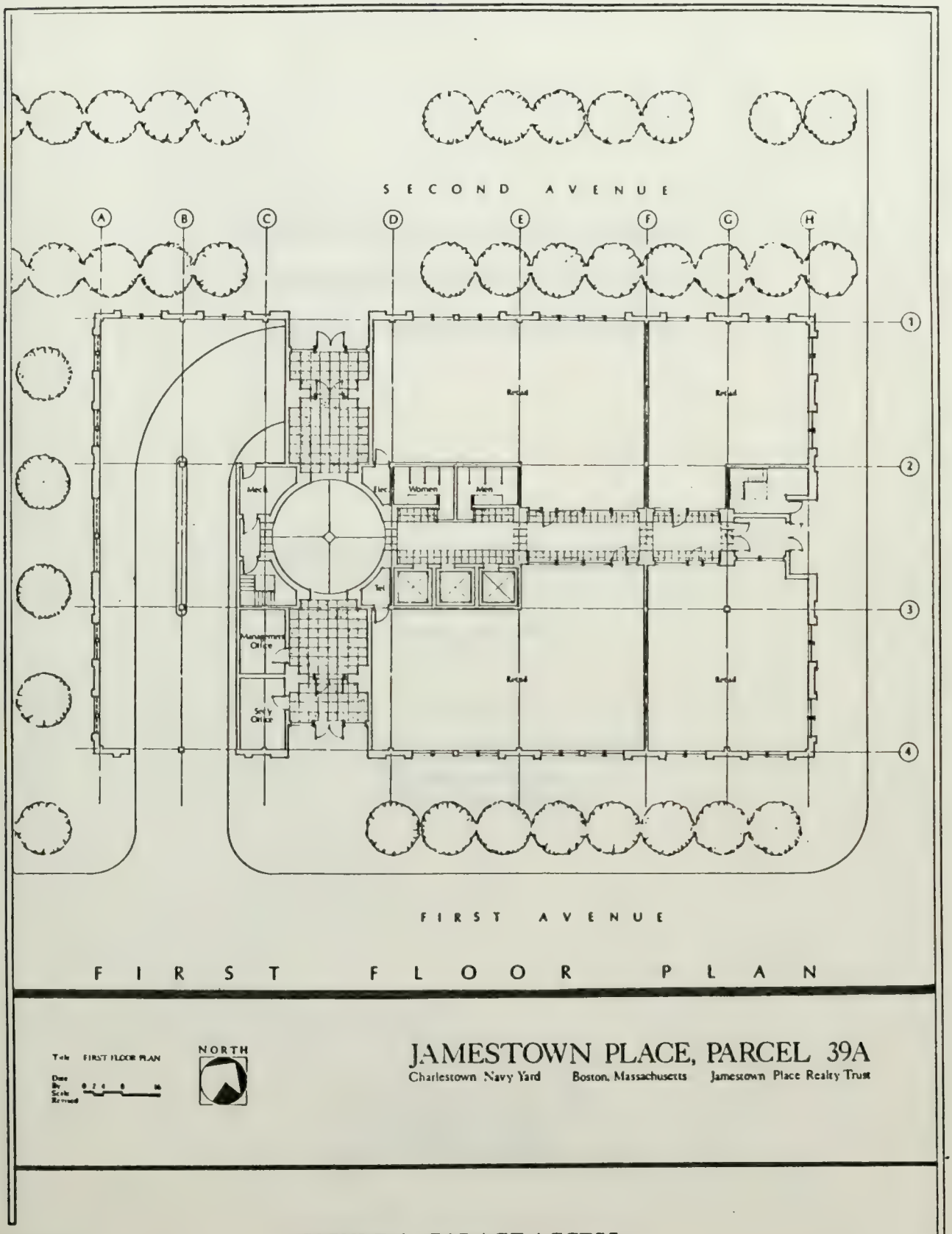


FIGURE 6: GARAGE ACCESS

TRANSPORTATION IMPACT OVERVIEW
FOR THE DEVELOPMENT OF PARCEL 39A
IN THE CHARLESTOWN NAVY YARD

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APPENDIX A: TRAFFIC COUNT DATA
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1. INTRODUCTION AND PROJECT DESCRIPTION

The proposed project consists of a retail and commercial development on Parcel 39A in the Charlestown Navy Yard. The location of this parcel within the Navy Yard is illustrated in Figure 1. The proposed development level is outlined below:

Use	Gross Square Feet
Retail	6,100
Commercial Office	93,700
Total	99,800

Parking will be provided, on-site, via a below-grade parking garage. Access will be provided via a single access onto First Avenue.

The following is a Transportation Impact Overview of the proposed project. This Overview was prepared to assist the City of Boston in assessing the proposed project in relation to the relatively modest transportation impacts created by the project. The Overview does not include an assessment of other development proposals within the Navy Yard. The focus of the work was on identifying the incremental impacts attributable to the proposed project. Cumulative impacts of the alternative development scenarios within the Navy Yard have previously been studied by the BRA.*

The Overview includes a preliminary assessment of the following:

- Existing Conditions in the vicinity of the project (i.e., within the Navy Yard gate area). AM and PM peak hour turning movement counts were taken at Gates 4 and 5 in 1988. In addition, two Automatic Traffic Recorder (ATR) machine counts were taken for a 24-hour period within the Navy Yard gates in 1988.

- Future Trip Generation from the project was estimated based on the development program and established trip generation rates, modified to recognize local circumstances of car ownership, transit availability and walking opportunities. Both person trips by mode of travel and vehicle trips are presented by AM and PM peak hour and for an average day.

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* Charlestown Navy Yard Urban Renewal Plan Amendment, Final Environmental Impact Report, Boston Redevelopment Authority, January 31, 1977.

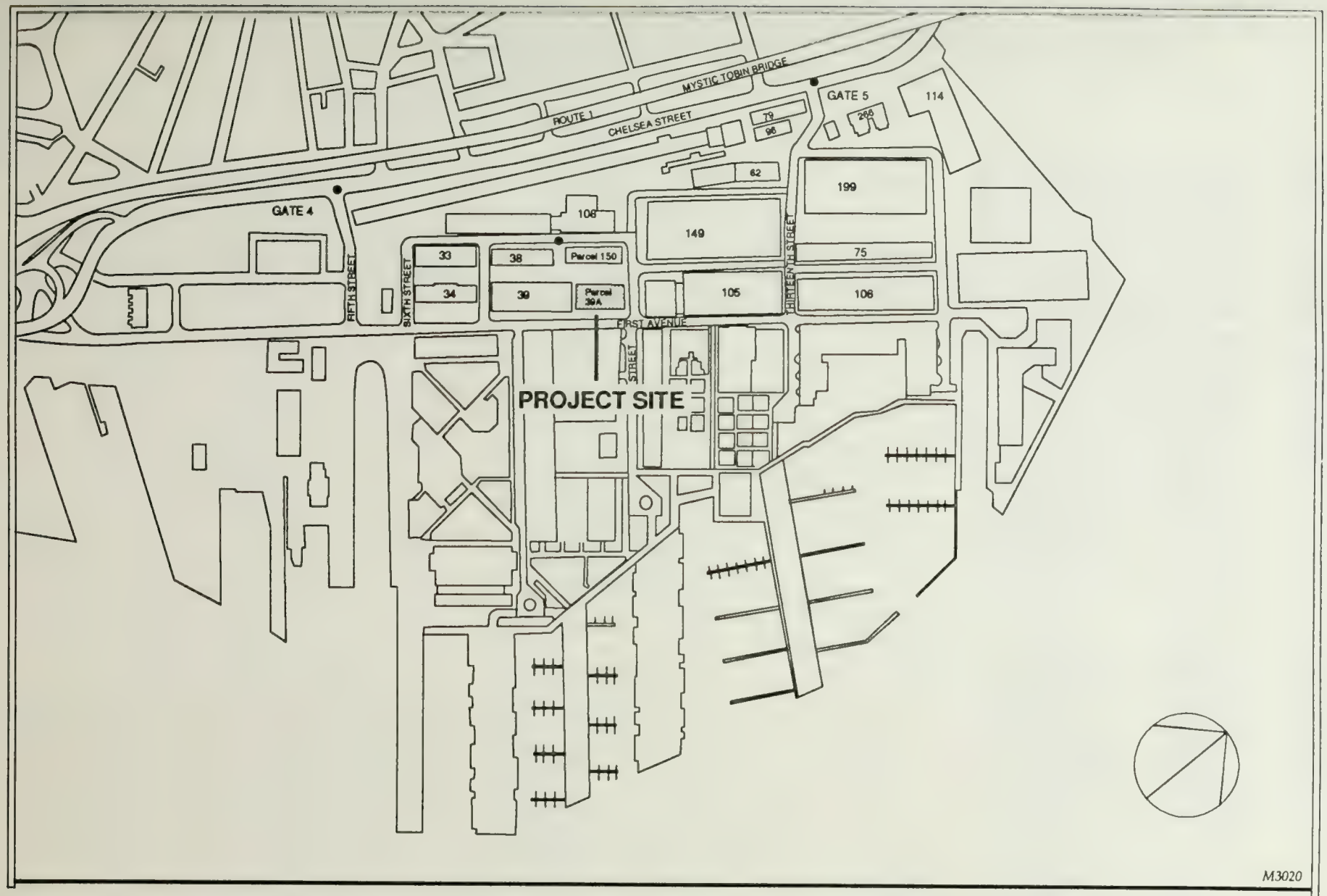


FIGURE 1: SITE LOCATION

- Parking Concerns were addressed, analyzing the relationship of supply and demand, allocation, physical access, car ownership, and other elements.

- Site Access and Circulation for the project was examined within the yard, extending to the access gates, including service to pedestrian and vehicles, parking, truck servicing and emergency access.

- Project Impacts were assessed with respect to both the functionality of the project and its relative effects on the supporting transportation systems and the surrounding area. Access, parking and construction impacts were also identified and assessed.

2. EXISTING CONDITIONS

2.1 Access and Circulation

The proposed project is located within the Charlestown Navy Yard. Access to/from the Navy Yard is provided at Gates 4 and 5 onto Chelsea Street. Chelsea Street is an east-west facility providing access, through City Square, to I-93 and Route 1. Connections are also provided along Chelsea Street north, to Somerville and Medford.

Within the Charlestown Navy Yard, access is provided along Fifth Street at Chelsea Street (Gate 4) and along Thirteenth Street at Chelsea Street (Gate 5). Both Fifth Street and Thirteenth Street are two lane, two-way collector roadways connecting to the major east-west roadway within the Navy Yard -- First Avenue.

Figure 2 illustrates the general circulation pattern of the collector roadways within the Navy Yard. Additional north-south, two-way roadways with the Navy Yard include Eighth Street and Ninth Street. Seventh Street is presently a one-way, northbound facility.

2.2 Traffic Volume Levels

As part of this Transportation Impact Overview, peak period turning movement counts were taken in February 1988 at the intersections of Chelsea Street at Fifth Street (Gate 4) and Chelsea Street at Thirteenth Street (Gate 5). These counts were taken for the period from 7:00 AM - 9:00 AM and 4:00 PM - 6:00 PM. The turning movement counts were taken to identify the peak one-hour traffic flows to be used in the traffic operations analysis. An additional count was performed in January 1989 at the intersection of First Avenue and Ninth Street during the AM and PM peak hours identified above. This count was used to analyse the operations of the site driveway at First Avenue.

In addition, Automatic Traffic Recorder (ATR) counts were taken along Fifth and Thirteenth Streets, south of Chelsea Street. This data was collected to identify hourly traffic volume variations during the course of a typical weekday period. The existing traffic data is presented in Appendix A.

The AM and PM peak hours occur between 7:45 - 8:45 AM and 4:30 - 5:30 PM, respectively. The magnitude of existing flows are summarized on Page 6.

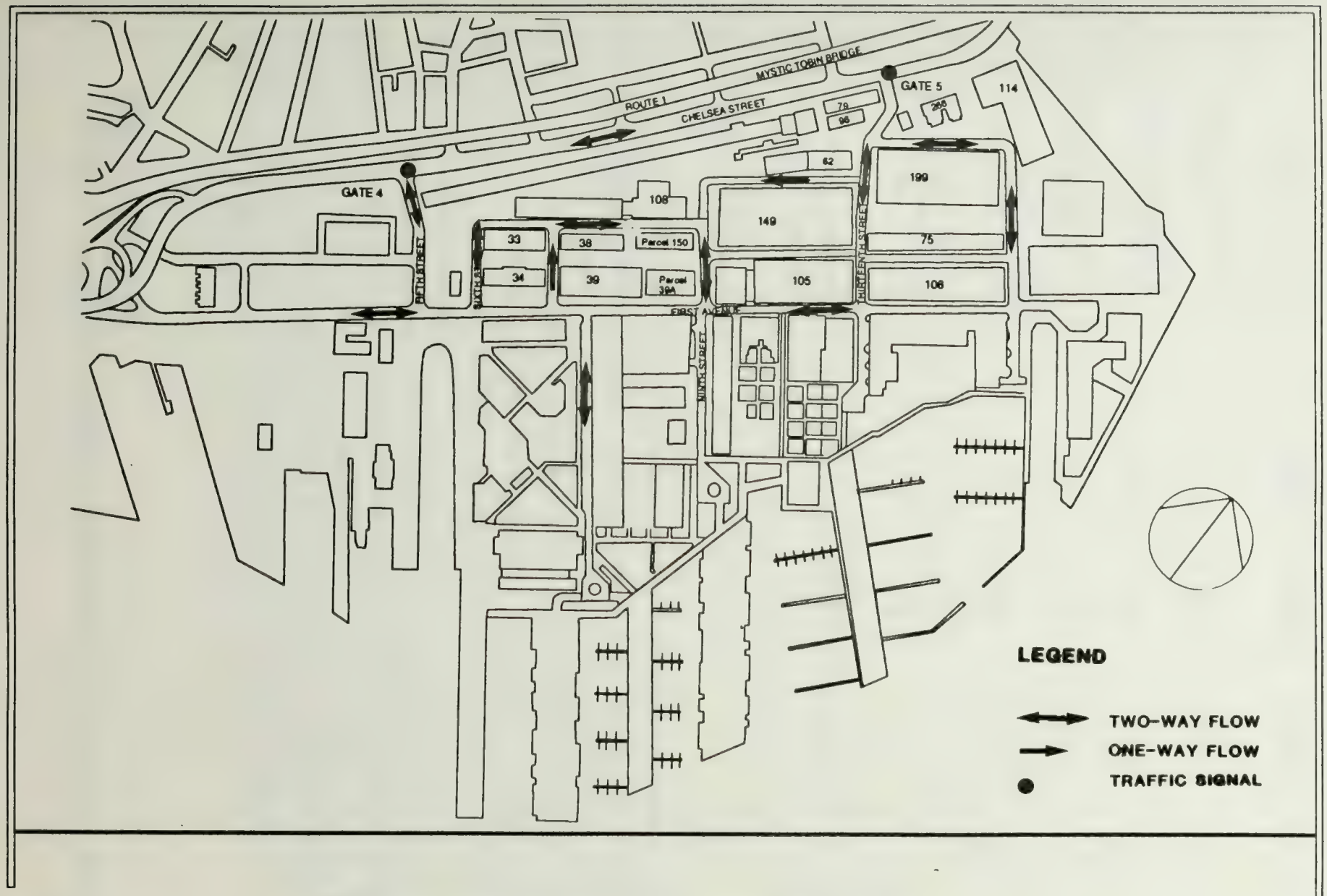


FIGURE 2: CHARLESTOWN NAVY YARD CIRCULATION

Street	AM Peak Hour EB/NB*	AM Peak Hour WB/SB**	PM Peak Hour EB/NB*	PM Peak Hour WB/SB**
• Chelsea Street east of Fifth Street	244	202	138	386
• Chelsea Street, east of Thirteenth Street	62	29	54	258
• Fifth Street, south of Chelsea Street	152	161	188	107
• Thirteenth Street, south of Chelsea Street	92	190	235	48
• Third Avenue, between Seventh Street and Ninth Street	5	25	5	27

Peak hour turning movements at Gates 4 and 5 are presented in Figures 3 and 4 for AM and PM peak hour periods, respectively.

2.3 Traffic Operations

Traffic operations were analyzed according to standard procedures and practices outlined in the 1985 Highway Capacity Manual***. The efficiency of traffic operations at a location, is measured in terms of Level of Service (LOS). The LOS refers to the quality of traffic flow along roadways and at intersections. It is described in terms of Levels A through F; where A represents the best possible conditions and F represents forced-flow or failing conditions. Generally, LOS C or better is considered acceptable (i.e., average delays), although in urban locations LOS D is also acceptable.

At signalized intersections, LOS is defined in terms of average approach delays. For unsignalized intersections, reserve capacities are used to determine LOS. These measures are discussed briefly below and Table 1 summarizes their inter-relationships. Average delay measures the mean stopped delay experienced by vehicles entering a signalized intersection during the peak hour period. Average delay is measured for each individual approach and the intersection as a whole. The LOS provided deteriorates with increasing average delays.

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* Eastbound or northbound.
** Westbound or southbound.
*** Transportation Research Board, Highway Capacity Manual, Special Report 209, 1985.

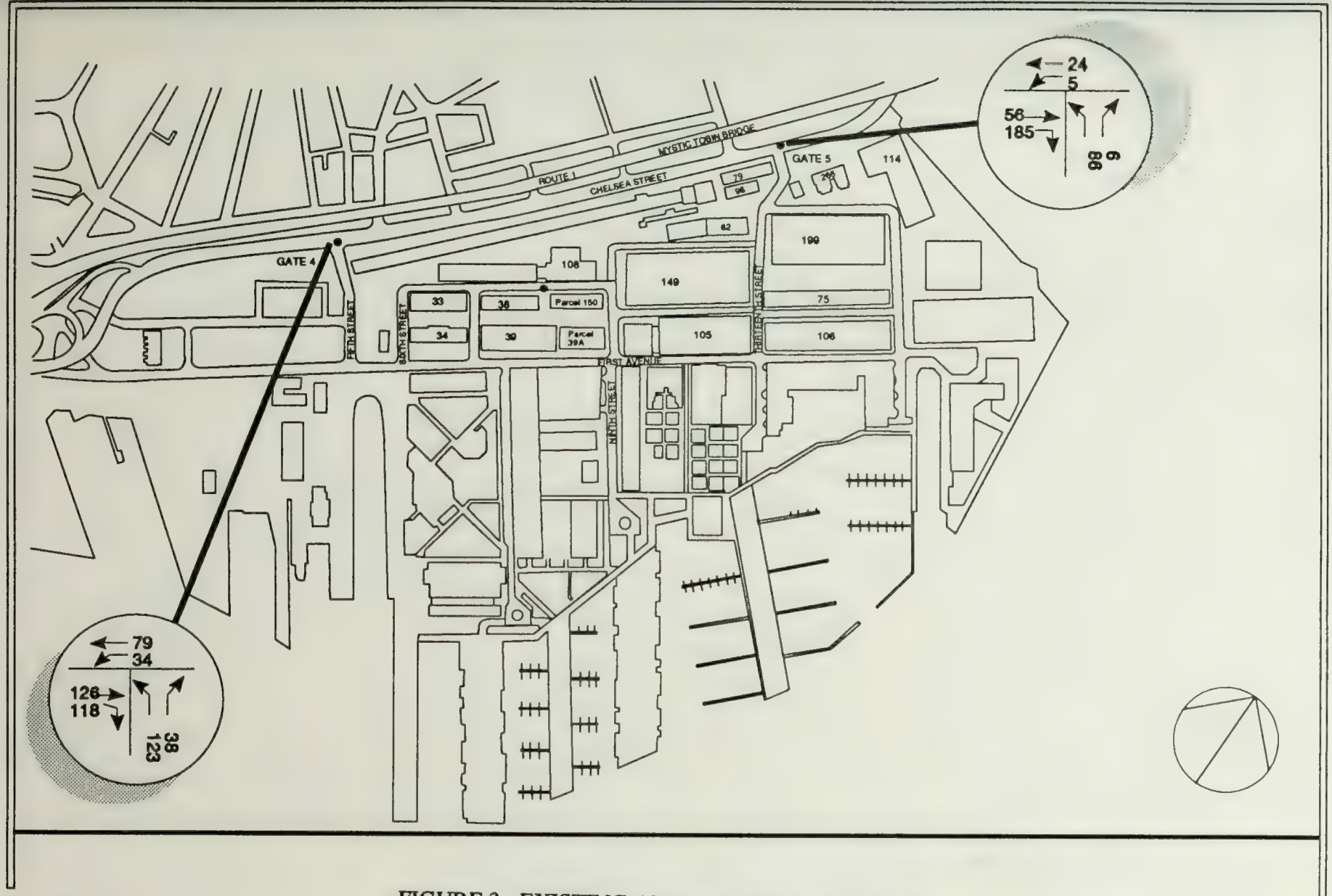


FIGURE 3: EXISTING AM PEAK HOUR VOLUMES

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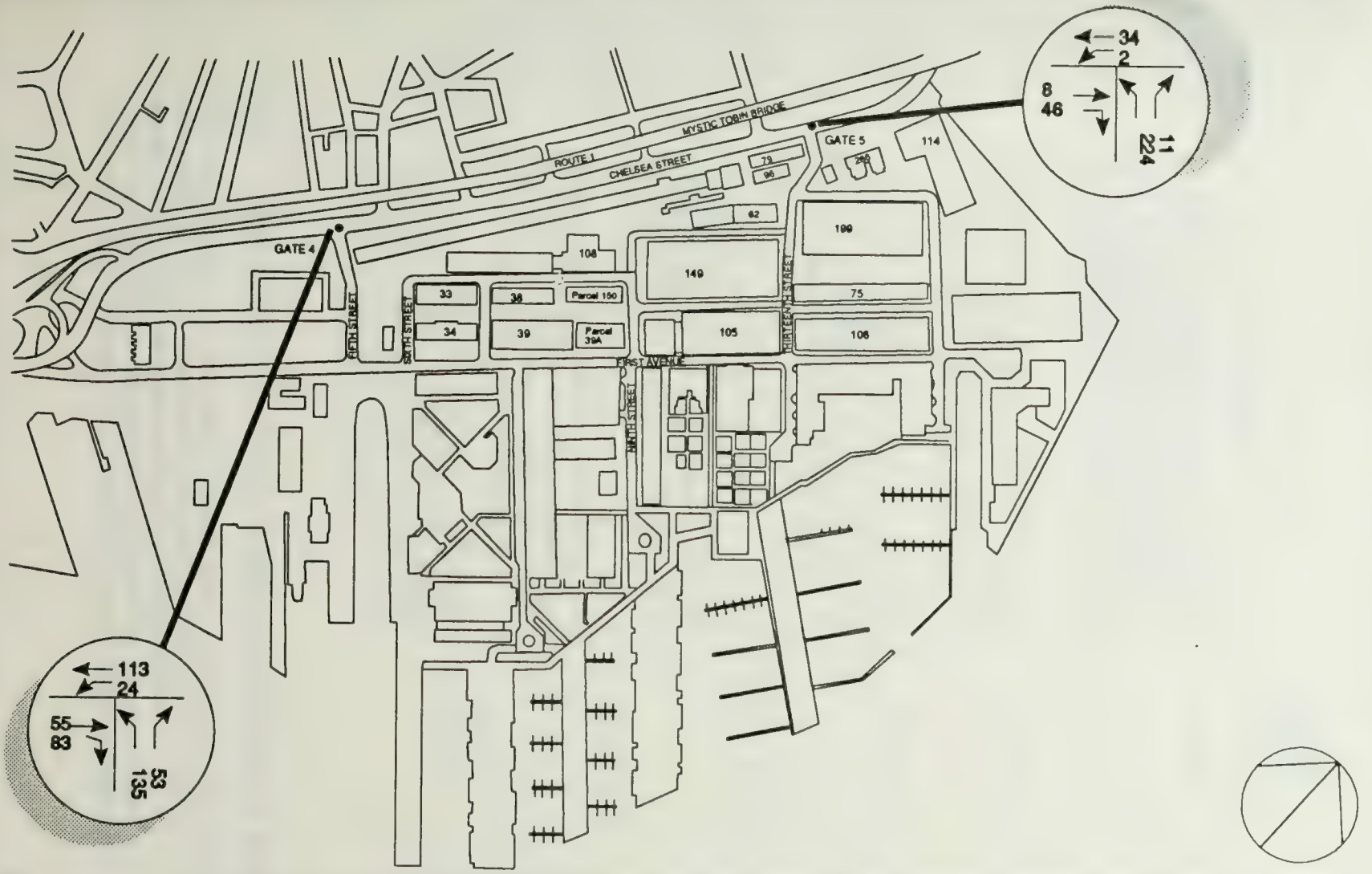


FIGURE 4: EXISTING PM PEAK HOUR VOLUMES

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TABLE 1

INTERSECTION LEVEL OF SERVICE (LOS) DESIGNATIONS*

Category	Description	Delay Range** (Seconds/ vehicle	Reserve*** Capacity (Vehicles Per Hour)
LOS A:	Describes a condition of free flow, with low volumes and relatively high speeds. There is little or no reduction in maneuverability due to the presence of other vehicles, and drivers can maintain their desired speeds with little or no delay.	0.00-0.50	400
LOS B:	Describes a condition of stable flow, with desired operating speeds relatively unaffected, but with a slight deterioration of maneuverability within the traffic stream.	5.1-15.0	300-399
LOS C:	Describes a condition still representing stable flow, but speeds and maneuverability begin to be restricted. The general level of comfort begins to deteriorate noticeably at this level.	15.1-25.0	200-299
LOS D:	Describes a high-density traffic condition approaching unstable flow. Speeds and maneuverability become more seriously restricted, and the driver experiences a poor level of comfort.	25.1-40.0	100-199
LOS E:	Represents conditions at or near the capacity of the facility. Flow is usually unstable, and freedom to maneuver within the traffic stream becomes extremely difficult.	40.1-60.0	0-99
LOS F:	Describes forced flow or breakdown conditions with queuing along critical approaches. Operating conditions are highly unstable as characterized by erratic vehicle movements along each approach.	60.1 or greater	N/A

* Source: Transportation Research Board, Highway Capacity Manual, Special Report 209, 1985.

** Delay ranges relate to the mean stopped delay incurred by all vehicles entering the intersection and do not consider the effects of traffic signal coordination. This criteria is intended for use in the evaluation of signalized intersections.

*** Reserve capacity refers to the unused capacity of the minor approach, on a per lane basis. This criteria is limited to use in the evaluation of unsignalized intersections.

At unsignalized intersections, reserve capacity is used to indicate LOS. The reserve capacity is the unused capacity of the minor approach (usually the stop or yield sign controlled approach). This measure, defined in passenger cars per hour, indicates how many more vehicles using an individual approach would be required to bring the intersection leg to capacity.

Highway capacity analyses were performed to identify peak hour (AM and PM) levels of service at the study area intersections for existing traffic conditions. The results of this analysis are presented in Table 2. Detailed LOS calculations for each of these analysis cases are presented in Appendix B.

At the present time, operations at the intersections of Chelsea Street at Fifth Street and Chelsea Street at Thirteenth Street are at LOS B or better during both the AM and PM peak hours.

2.4 Transit Service

Three MBTA bus routes serve the Charlestown Navy Yard area. Two of these routes (Routes 92 and 93) provide service to Sullivan Square and around Charlestown. The third route (111) provides services between Haymarket Square and Revere. Route 111 is the only route with a stop at one of the gates of the Navy Yard. Bus route 93 provides services to a stop at the intersection of Henley and Chelsea Streets, which is a short walk from the Navy Yard. The approximate frequencies for routes 93 and 111 are shown in Table 3. The relation of the project to the transit system is shown in Figure 5.

Both Routes 92 and 93 stop at a MBTA rapid transit stations. Route 111 stops at the Haymarket Station of the Green and Orange Lines. The Green Line provides service throughout downtown Boston, as well as to Lechmere, Boston College, Cleveland Circle, Riverside (Newton), and Arborway. The Orange Line provides service to Oak Grove to the north and Forest Hills to the south. Route 93 stops at the Sullivan Square Station of the Orange Line.

TABLE 2
EXISTING TRAFFIC OPERATIONS

	Intersection	Movement	AM Peak Hour LOS	AM Peak Hour Average Delay (Seconds)	PM Peak Hour LOS	PM Peak Hour Average Delay (Seconds)
(1)	Chelsea Street	EB	B	8.8	B	7.7
	at Fifth Street	WB	B	7.5	B	7.5
	(Gate 4)	NB	B	8.3	B	8.8
		OVERALL	B	8.3	B	8.0
(2)	Chelsea Street	EB	B	5.6	B	7.2
	at Thirteenth Street	WB	A	4.0	B	6.9
	Gate 5)	NB	B	7.7	B	5.6
		OVERALL	B	6.0	B	6.0

TABLE 3

BUS ROUTE CHARACTERISTICS

Bus Route	Approximate Frequency (Minutes)				
	Rush Hours	Weekday			
		Day	Night	Sat.	Sun.
93	8	30	60	30	60
111	6/8	20	60	20	60

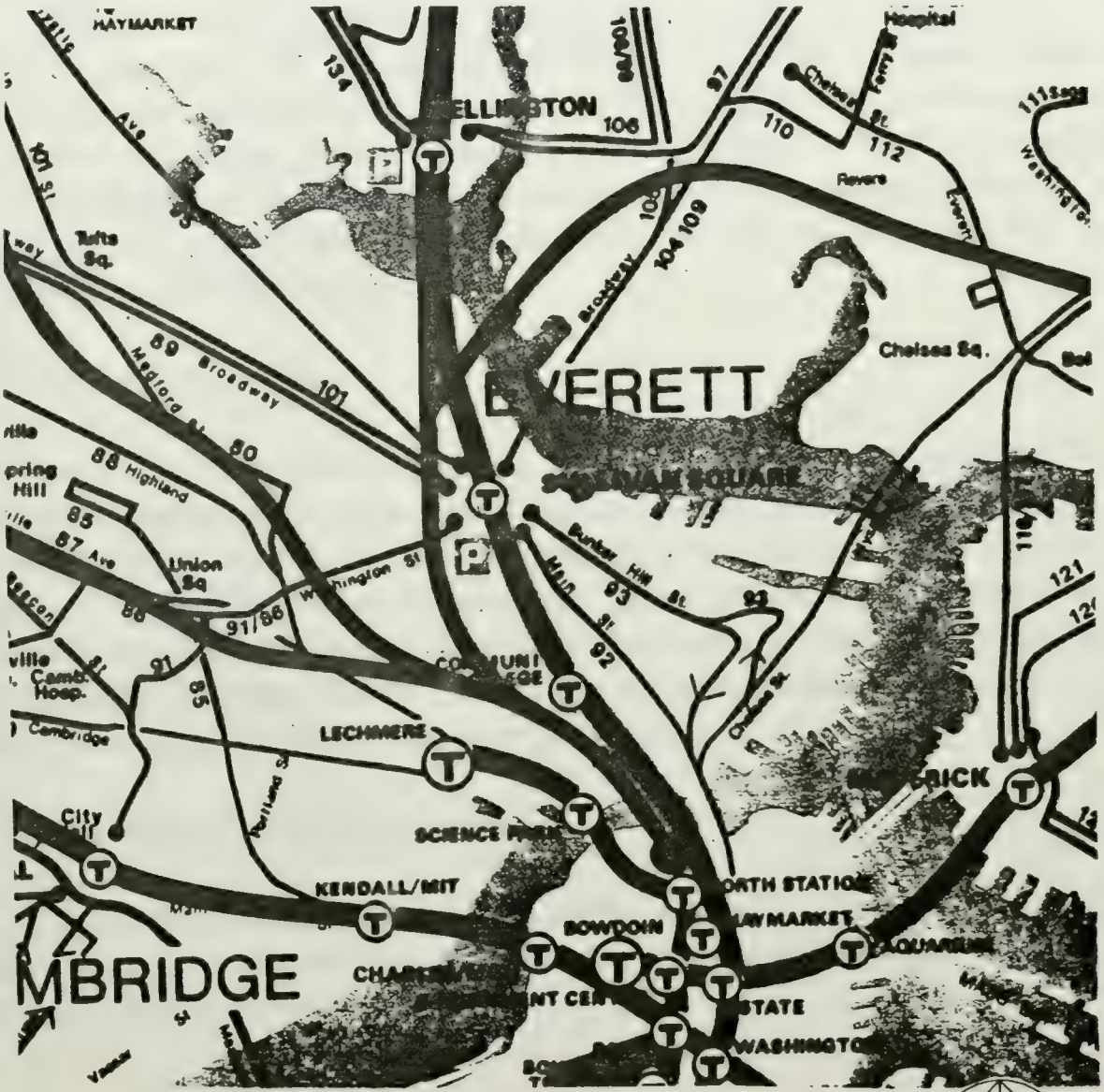


FIGURE 5: RELATION TO TRANSIT SYSTEM

3. FUTURE TRIP GENERATION

The following section deals with the amount of trips generated by the proposed project, broken down by the mode of tripmaking -- automobile or public transit. These estimates form the basis for assessing impacts of the project on transportation systems as well as on project functioning.

Starting with an estimate of the number of person trips generated per weekday by the retail and office components of the development, total daily person trips were calculated. These were then divided into each travel mode. The number of trips occurring in the peak hours was then derived from these figures. A vehicle occupancy factor was applied to convert auto person trips into auto vehicle trips. This analysis yields weekday and peak hour person and vehicle trips generated by the project. These trips were then distributed onto area streets according to an estimate of trip origins and destinations.

3.1 Person Trip Generation

The Boston Transportation Department has published a draft set of guidelines for the preparation of transportation access plans in the City*. These quidelines contain a set of trip generation rates typical for Boston for various land uses. These rates were used to calculate the number of person trips generated by this project. Modal splits were also obtained from this document. Auto occupancy data was based on information presented in the Copely Place EIR** and the 500 Boylston Street DEIR***. The resultant trip generation rates and person and vehicle trip estimates associated with the proposed project are presented in Table 4.

3.2 Distribution to Transportation Facilities

The distribution of project vehicle trips was based upon data presented in the BRA Final Environmental Impact Report**** and upon a review of existing traffic counts at Gates 4 and 5. The general distribution is as follows:

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* Transportation Access Plans Guidelines, Draft Copy, Boston Transportation Department. (not dated)

** Copley Place Environmental Impact Report, HMM Associates, 1980.

*** 500 Boylston Street Draft Environmental Impact Report, October 1984.

**** Charlestown Navy Yard Urban Renewal Plan Amendment, Final Environmental Impact Report, BRA, January 31, 1977.

TABLE 4

TRIP GENERATION SUMMARY

1. SCALE:
   - 6,100 GSF Retail Use
   - 93,700 GSF Commercial Office

   Total: 99,800 GSF

2. ESTIMATED TRAVEL CHOICES

- **Retail**

Modal Split Percentages:*	Transit	Automobile	Walk/Other
Work:	48%	42%	10%
Non-Work:	23%	67%	10%

Occupancy:*

Employees:	1.4 per vehicle
Non-Employees:	1.6 per vehicle

- **Commercial Office**

Modal Split Percentages:*	Transit	Automobile	Walk/Other
Work:	48%	42%	10%
Non-Work:	23%	67%	10%

Occupancy:*

Employees:	1.5 per vehicle
Non-Employees:	1.2 per vehicle

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* Sources: Copley Place Environmental Impact Report, HMM Associates, Inc. 1980.

500 Boylston Street Draft Environmental Impact Report, HMM Associates, Inc., October 1984.

BRA Report on 1980 Census ("Diversity and Change in Boston's Neighborhoods"), adjusted to account for location within Charlestown and available transit.

3. TRIP GENERATION

- **Retail**

		Average Daily	AM Peak Hour In	AM Peak Hour Out	PM Peak Hour In	PM Peak Hour Out
Person Rates Per 100 GSF	Work:	2.8	0.3	0.1	0.3	0.6
	Non-Work:	15.9	0.0	0.1	0.8	1.6
No. Transit Users (persons)	Work:	8	1	0	1	2
	Non-Work:	22	0	0	1	2
	Total:	30	1	0	2	4
Walk/Other (persons)	Work:	2	0	0	0	0
	Non-Work:	10	0	0	1	2
	Total:	12	0	0	1	2
Automobiles (persons)	Work:	7	1	1	1	2
	Non-Work:	65	0	1	3	6
	Total:	72	1	2	4	8
Vehicle Trips (vehicles)	Work:	5	1	1	1	1
	Non-Work:	41	0	1	2	4
	Total:	46	1	2	3	5

- **Commercial Office**

		Average Daily	AM Peak Hour In	AM Peak Hour Out	PM Peak Hour In	PM Peak Hour Out
Person Rates Per 1000 GSF	Work:	4.3	1.7	0.0	0.1	1.5
	Non-Work:	2.4	0.4	0.2	0.2	0.3
No. Transit Users (persons)	Work:	193	76	0	4	68
	Non-Work:	52	9	4	4	6
	Total:	245	85	4	8	74
Walk/Other (persons)	Work:	40	16	0	1	14
	Non-Work:	23	4	2	2	3
	Total:	63	20	2	3	17
Automobiles (persons)	Work:	170	67	0	4	59
	Non-Work:	150	24	13	13	19
	Total:	320	91	13	16	78
Vehicle Trips (vehicles)	Work:	94	37	0	2	33
	Non-Work:	125	20	11	11	16
	Total:	219	57	11	13	49
Total Trips:						
Transit (persons)		275	86	4	10	78
Cars (vehicles)	Work:	99	38	1	3	34
	Non-Work:	166	20	12	13	20
	Total Vehicles:	265	58	13	16	54

* Source: Transportation Access Plans Guidelines, Boston Transportation Department, Draft.

Trip Distribution	%
• Vehicles traveling through Charlestown to Chelsea Street to/from the north	30%
• Vehicles entering/exiting the site from Chelsea Street, east of the Navy Yard to/from points south, east and west	70%

3.3 Parking Demand

Parking demand for an office or retail land use is related to the decision to use a private vehicle on a particular trip. Thus the demand for parking is directly related to the number of vehicles driven to the site. In an urban area with readily available access to transit, the demands for parking are less than in a suburban setting. In a facility such as this one, vehicles will be generated for both work and non-work related uses. The parking demand rates used reflect this difference. For work related vehicle trips there is a direct one-to-one relationship: 25 work (or employee) related daily trips require 25 parking spaces. For non-work related trips this rate is less due to the fact that most non-work related trips do not require use of a parking space for the entire day. This turnover in parking demand is reflected in the use of a 2.67 turnover rate*. Thus, 25 non-work daily trips would require only nine parking spaces. Using these rates the estimated parking demand for this facility is 161 spaces. Table 5 summarizes the parking demand by use and trip purpose.

The project will contain 99 spaces on-site in the below grade parking garage. This quantity will be sufficient to meet the demands of all work trips generated by both the retail and office components of the project. The remaining demand of 62 non-work related trips will be met by designating a sufficient number of spaces in the parking structure located in Building 199 which currently has a surplus of parking spaces. The Boston Redevelopment Authority is presently investigating the metering of on-street parking in the shipyard, and this could also have the potential of providing additional space for non-work related trips to the project.

TABLE 5
PROJECT PARKING DEMAND

	Work Trips		Non-Work Trips	
Use	Trips	Demand	Trips	Demand
Retail	5	5	41	15
Office	94	94	125	47
Total	99	99	166	62

Total Demand: 161 Spaces

In summary, the impacts associated with the proposed project are quite modest with respect to the existing levels of transit and automobile use in the area. Average daily vehicle trips for the project have been estimated at 265 in and 265 out. In the PM peak hour, 16 vehicles are expected to enter and 54 leave the premises. Morning peak traffic will be 58 trips in and 13 out.

4.1 Transit/Pedestrian Impacts

Given the proximity of the proposed project to three MBTA bus routes, each of which provides service to a rapid transit station, no severe restrictions will be placed on transit use. The project is expected to generate a maximum of 90 transit trips during the AM peak hour and 88 during the PM peak. Given that a minimum of seven and a half buses are scheduled to pass the Navy Yard on each route, this level of demand should not place any stress on the transit system. Additionally, an earlier proposal by the BRA to provide bus service into the Navy Yard would increase transit ridership and reduce traffic.

4.2 Garage Access

The proposed underground parking garage will provide direct access to First Avenue. The general layout of the garage, in relation to First Avenue, is illustrated in Figure 6. As indicated in Section 4.3 below, the layout will be sufficient to adequately service the estimated vehicle demand.

4.3 Traffic Volumes with the Proposed Project

The previously presented project vehicle trip estimates were added to the existing AM and PM peak hour flows to develop peak hour volumes with the proposed project. These volumes are presented in Figures 7 and 8 for AM and PM peak hour periods, respectively.

4.4 Traffic Operations

The magnitude of vehicular traffic generated by the project will not cause any noticeable lowering of traffic levels of service, compared to existing conditions. Increases in vehicle delays due to project traffic at adjacent signalized intersections will be modest. Table 6 presents

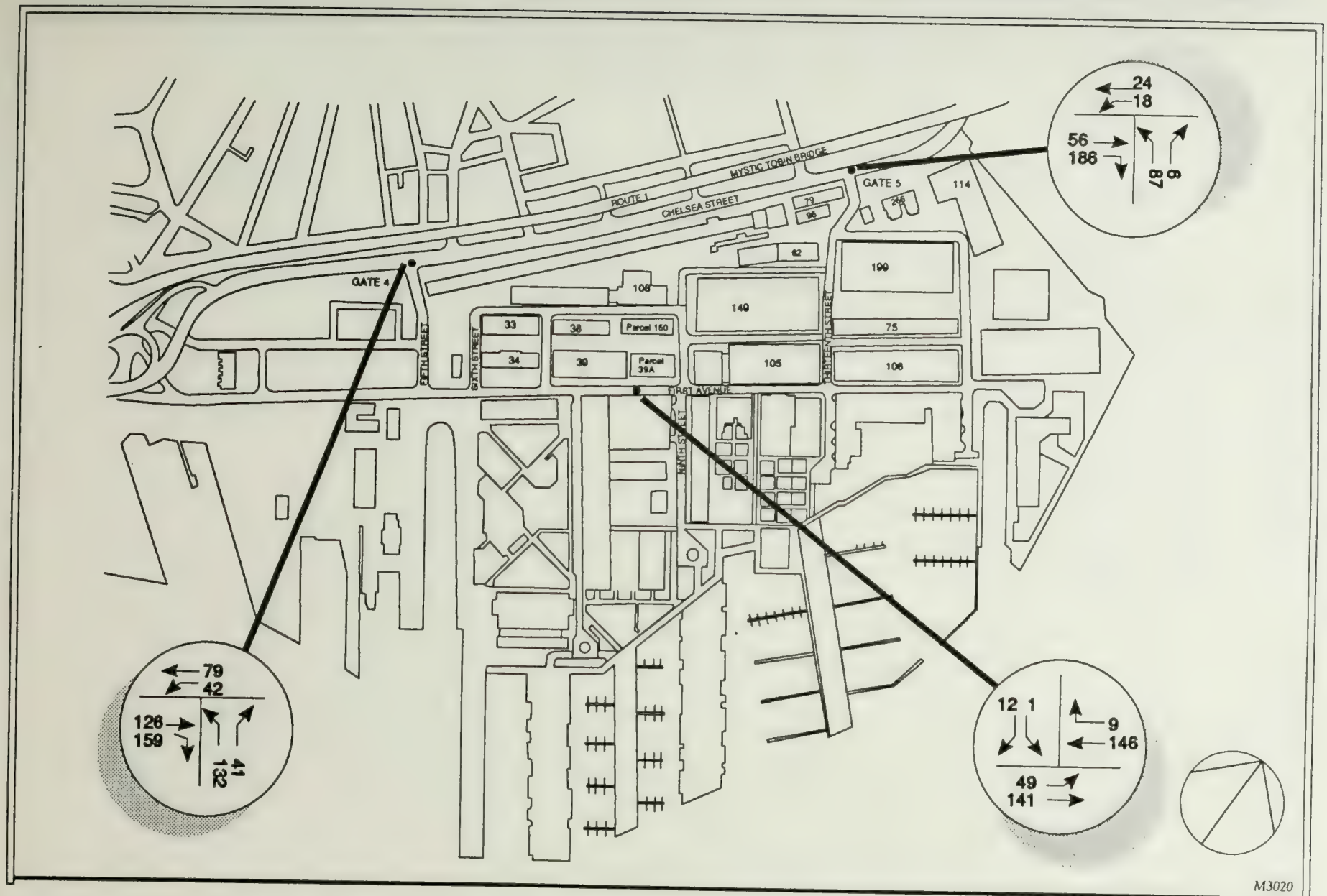


FIGURE 7: AM PEAK HOUR VOLUMES WITH THE PROPOSED PROJECT

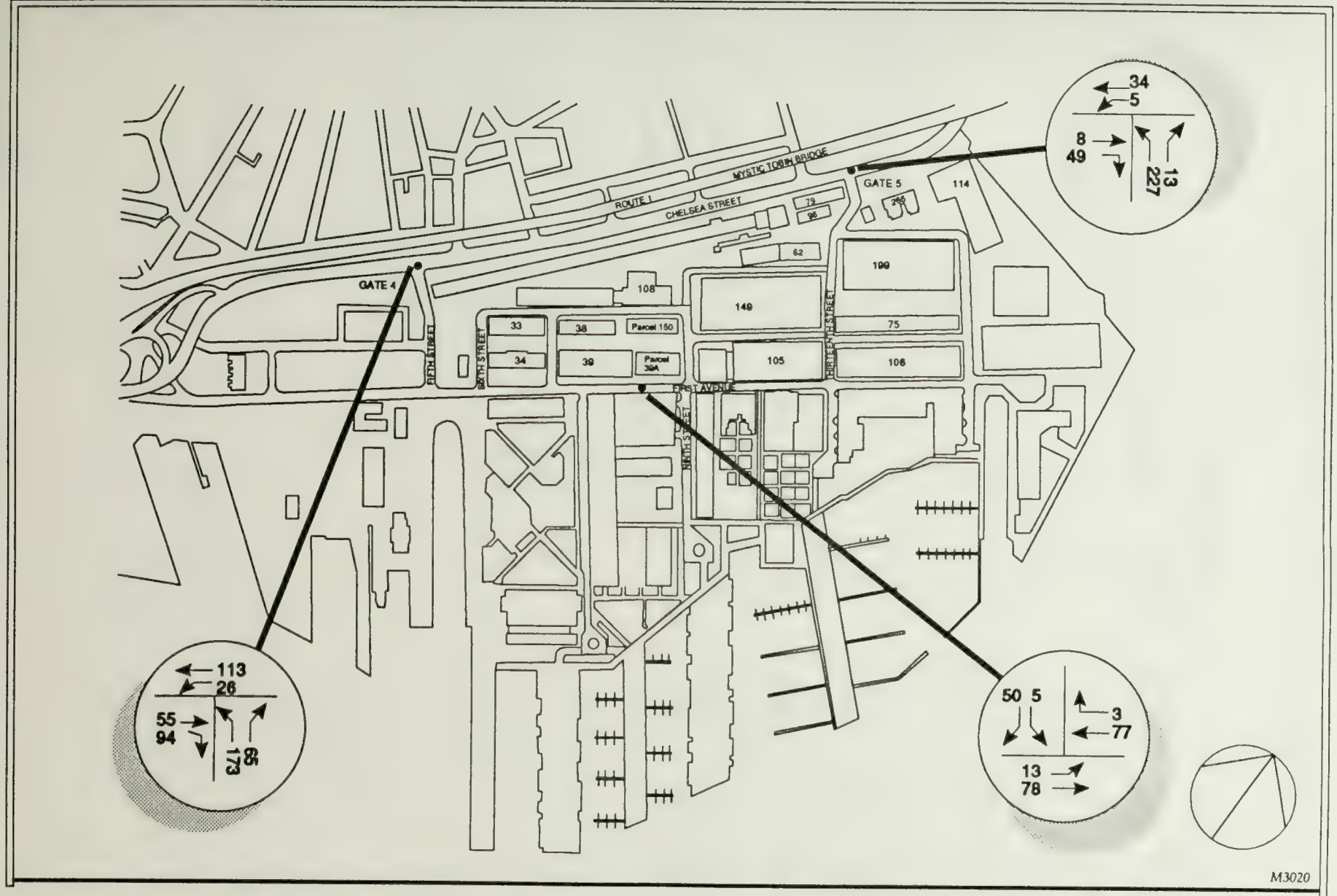


FIGURE 7: PM PEAK HOUR VOLUMES WITH THE PROPOSED PROJECT

TABLE 6

TRAFFIC OPERATIONS WITH THE PROPOSED PROJECT

	Intersection	Movement	AM Peak Hour LOS	AM Peak Hour Average Delay	AM Peak Hour Reserve Capacity	PM Peak Hour LOS	PM Peak Hour Average Delay	PM Peak Hour Reserve Capacity
(1)	Chelsea Street at	EB	B	9.8	NA	B	7.8	NA
	Fifth Street	WB	B	7.7	NA	B	7.6	NA
	(Gate 4)	NB	B	8.4	NA	B	10.1	NA
		OVERALL	B	8.9	NA	B	8.7	NA
(2)	Chelsea Street at	EB	B	5.6	NA	B	7.3	NA
	Thirteenth Street	WB	A	4.0	NA	B	6.9	NA
	(Gate 5)	NB	B	7.7	NA	B	5.7	NA
		OVERALL	B	5.9	NA	B	6.1	NA
(3)	Project Access	EB	A	NA	976	A	NA	1094
	at First	SB	A	NA	973	A	NA	1021
	Avenue	OVERALL	A			A		

NA = Not Applicable

a summary of peak hour traffic operations with the proposed project. A review of this table indicates that peak hour operations with the proposed project will not change appreciably compared to existing conditions. AM and PM peak hour operations with completion of the proposed project will be at LOS B or better at both Gates 4 and 5. At the intersection of the project garage access with First Avenue, AM and PM peak hour operations will be at LOS A. Vehicle queuing into and out of the garage will be insignificant.

4.5 Parking

The proposed project will provide a total of 99 parking spaces for retail and office use. The 99 spaces provided on site will be reserved for employees. The remaining demand generated by the project will be met by reserved parking provided in the Building 199 parking structure. Parking will be provided in a garage beneath the parcel. Access to the garage will be via First Avenue and will include one lane in and one lane out, which will be sufficient to meet peak demands.

4.6 Loading and Taxis

For commercial uses, loading will take place on-street. This will occur primarily during off-peak periods and due to the baseline volume along adjacent roadways, should not impact operations in the area.

4.7 Construction Activity

Conditions may require some offsite storage of materials and equipment. Over the project construction period, the number of workers will vary. Parking in nearby offstreet facilities will be encouraged, along with maximum carpooling. After the foundation and garage work is completed, limited onsite parking will be available.

5. MITIGATING MEASURES

5.1 Transportation Management

As a basic element of transportation management, the developer intends to foster a transportation component within the building management organization. This "transportation office" will be the means of implementing the access program among the employees, as a service. On a day-to-day basis, this function will be served by a cooperative effort between the employers and the physical management staff.

5.1.1 Transit/Pedestrian Measures - Provision of bus service within the Navy Yard has the potential to increase the transit share of project trips. Existing service stops outside the Navy Yard. Initiation of service in the Navy Yard providing more direct access to the MBTA Rapid Transit lines and the Downtown would promote greater ridership, especially during peak periods. The original Charlestown Navy Yard EIR* prepared by the BRA discussed plans for the provision of MBTA bus service in the Navy Yard to the Orange Line in Charlestown and a shuttle bus to Haymarket Station.

5.1.2 System Operational Improvements - Operational controls on the area streets should be reviewed to assure that missing signs are replaced, cross-walk markings restored to good condition, and signal timing checked for good balance between vehicular and pedestrian requirements.

Long range plans are proceeding for the reconstruction and depression of the Central Artery along with a new Third Harbor Tunnel. This massive undertaking in the core area will eliminate or at least strongly alleviate some current major problems so that traffic will be less likely to reroute to more local streets, but stay on the major arterial facilities.

5.2 Parking Management

The volume of cars entering or leaving at any one time is projected to be relatively small and the total supply of 99 spaces on-site coupled with the reserved spaces at Building 199 is projected to be more than adequate to service project vehicle demands.

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* Charlestown Navy Yard Renewal Plan Amendment, Final Environmental Impact Report, BRA, January 31, 1977.

The project proponent will discuss, with the city, various ways to designate space uses in an attempt to better service the area in general.

5.3 Construction Management

In order to mitigate the transportation-related impacts of construction, care must be taken to limit the size of the construction site with respect to encroachment on adjacent streets, the timing, routing and intensity of construction vehicles, and the access conditions of workers. Street encroachments involving City permitting and the use of streets by trucks and parking also fall under City control. Construction management measures must therefore be closely coordinated with City departments -- Inspectional Services, Public Works, Transportation -- and for permanent easements or physical street changes, with the multi-departmental Public Improvements Commission.

Some limitations exist in detailing a construction management plan prior to the public permitting process and months in advance of construction itself. The City permits and controls require specific input from the City agencies responsible, who must take into account expected conditions at the time of construction, including coordination with other public, private or utility construction going on at the same time. With this in mind, it is only possible at this time to state a number of principles which will govern the construction process in order to reduce negative impacts.

5.3.1 Control of Trucks - Trucks transporting materials and equipment to and from the site will be routed on major streets to avoid residential neighborhoods. Control of access times will be imposed so that peak hour disruptions will be avoided. Such peak hour congestion is as detrimental to the construction process as it is to general traffic. At and near the site, truck maneuvering will be supervised by flagmen or policemen, and time at the site will be kept at a minimum. Police supervision will be required when excavations are being made into the street, and at other times when required by construction activities. Controls governing the spilling of materials from trucks will be observed.

5.3.2 Street/Sidewalk Encroachments - Care will be taken to fence in the construction area and provide, through signing and physical construction, alternate pedestrian ways as necessary, all subject to City permits. The worst period in this respect will be during the excavation and foundation construction phase. The

establishment of staging areas at nearby locations will be investigated to mitigate the severity of encroachments.

5.3.3 Worker Parking - To reduce the number of worker vehicles coming to the site area and attempting to park onstreet, workers will be encouraged to take transit or carpool. After the foundation work has been completed, some worker parking onsite will be possible.

5.4 Monitoring

One of the most effective ways to guarantee the long range viability of the project is to plan periodic monitoring of access conditions. The developer is committed to do this for good management of the development and to help achieve public goals in transportation. On an annual basis, surveys will be taken and previous years' records will be assembled to show the travel practices of building residents and visitors -- car ownership, trip generation, the modal split achieved, tenant and visitor parking utilization, car rental experience, loading activities, etc. This annual review will occur on the anniversary of the issuance of the Certificate for Use and Occupancy by the City. Cooperation from the City will be expected on the necessary survey forms and required data. A summary report will be prepared and discussed with the City to review how well the project performed from a transportation vantage point. Where problems or opportunities are found, appropriate responses from both the development and the public sector will be sought.

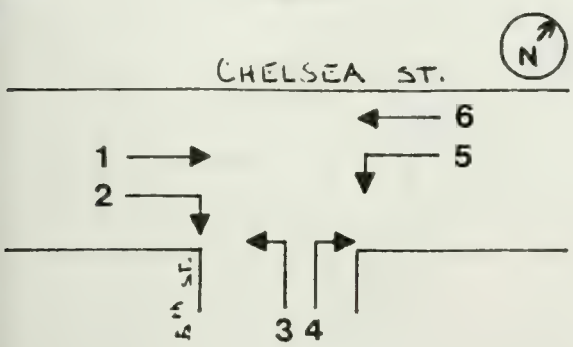
APPENDIX A

TRAFFIC COUNT DATA

HMM ASSOCIATES
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TRAFFIC ANALYSIS

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GEOMETRY



JOB NO: 2397 TOWN/CITY: CHARLESTOWN DATE: 02/11 88

DAY OF WEEK: THURSDAY WEATHER: CLOUDY RECORDERS: SHG

INTERSECTION: CHELSEA ST./FIFTH ST.(GATE 4)

REMARKS:

PEAK HOUR AT THIS LOCATION: 7:45-8:45 AM

PEAK HOUR FOR THE STUDY AREA: 7:45-8:45 AM

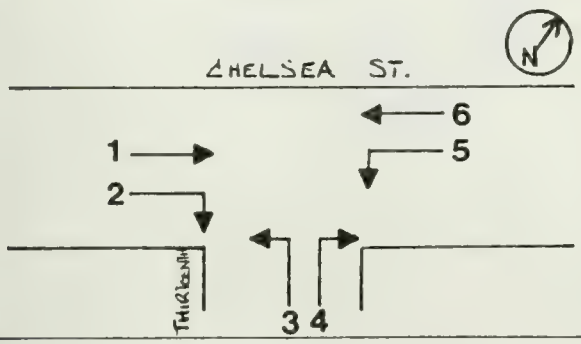
VEHICLE COUNT

	1		2		3		4		5		6	
TIME PERIOD	AUTOS	TRCKS	AUTOS	TRCKS	AUTOS	TRCKS	AUTOS	TRCKS	AUTOS	TRCKS	AUTOS	TRCKS
7:00-7:15 AM	16	5	10	3	17	0	4	0	7	0	21	3
7:15-7:30 AM	24	14	29	0	23	0	4	1	5	0	10	6
7:30-7:45 AM	33	5	23	1	22	1	5	1	5	0	14	8
7:45-8:00 AM	23	6	20	4	30	3	9	0	3	0	12	2
8:00-8:15 AM	27	4	30	1	36	1	15	0	8	0	19	3
8:15-8:30 AM	28	6	26	3	25	0	8	1	12	0	16	5
8:30-8:45 AM	27	5	31	3	28	0	5	0	11	0	14	8
8:45-9:00 AM	25	4	27	2	24	0	3	0	10	0	11	5
UDY AREA PEAK OUR VOLUMES												
TAL: VEHICLES	126		118		123		38		34		79	
% TRUCKS	17%		9%		3%		3%		0%		23%	

HMM ASSOCIATES
COUNTSUM®
TRAFFIC ANALYSIS

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GEOMETRY



JOB NO: 1397 TOWN/CITY: CHARLESTOWN DATE: 02/10/88

DAY OF WEEK: WEDNESDAY WEATHER: CLEAR RECORDERS: SHG

INTERSECTION: CHELSEA ST./THIRTEENTH ST.(GATE 5)

REMARKS:

PEAK HOUR AT THIS LOCATION: 7:30-8:30 AM

PEAK HOUR FOR THE STUDY AREA: 7:45-8:45 AM

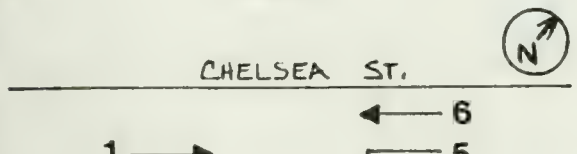
VEHICLE COUNT

	1		2		3		4		5		6	
TIME PERIOD	AUTOS	TRCKS	AUTOS	TRCKS	AUTOS	TRCKS	AUTOS	TRCKS	AUTOS	TRCKS	AUTOS	TRCKS
7:00-7:15 AM	6	8	23	1	13	1	0	1	0	0	8	5
7:15-7:30 AM	15	12	15	2	7	2	1	0	3	0	3	1
7:30-7:45 AM	11	4	40	1	18	4	1	0	3	1	5	3
7:45-8:00 AM	17	1	51	3	20	2	2	0	0	0	2	3
8:00-8:15 AM	7	8	29	1	22	3	1	1	2	0	1	2
8:15-8:30 AM	8	7	60	3	17	2	2	0	1	0	1	4
8:30-8:45 AM	5	3	37	1	17	3	0	0	2	0	5	6
8:45-9:00 AM	4	3	45	2	12	2	1	0	1	0	3	4
STUDY AREA PEAK HOUR VOLUMES												
TOTAL: VEHICLES	56		185		86		6		5		24	
% TRUCKS	34%		4%		12%		17%		0%		63%	

HMM ASSOCIATES
COUNTSUM®
TRAFFIC ANALYSIS

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GEOMETRY



JOB NO: 2397 TOWN/CITY: CHARLESTOWN DATE: 02 10 98

DAY OF WEEK: WEDNESDAY WEATHER: CLEAR RECORDERS: SHG

INTERSECTION: CHELSEA ST./FIFTH ST.(GATE 4)

REMARKS:

PEAK HOUR AT THIS LOCATION: 4:30-5:30 PM

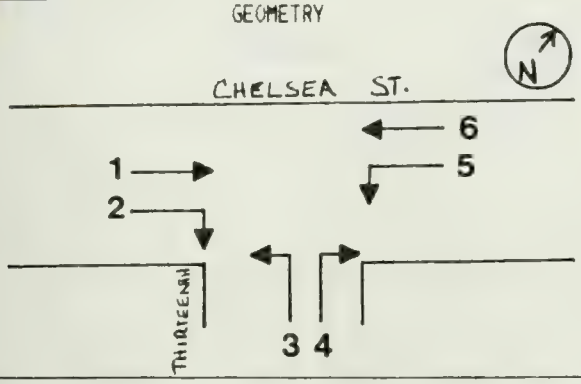
PEAK HOUR FOR THE STUDY AREA: 4:30-5:30 PM

VEHICLE COUNT

	1		2		3		4		5		6	
TIME PERIOD	AUTOS	TRCKS	AUTOS	TRCKS	AUTOS	TRCKS	AUTOS	TRCKS	AUTOS	TRCKS	AUTOS	TRCKS
4:00-4:15 PM	9	1	13	0	26	1	6	0	5	0	14	2
4:15-4:30 PM	11	1	20	0	24	0	3	0	4	0	16	5
4:30-4:45 PM	13	1	14	1	32	1	15	0	6	0	22	4
4:45-5:00 PM	12	2	30	0	32	1	11	0	5	0	29	4
5:00-5:15 PM	14	2	15	2	44	1	18	0	8	0	32	3
5:15-5:30 PM	9	2	20	1	24	0	9	0	5	0	15	4
5:30-5:45 PM	12	2	25	0	20	1	7	0	6	0	8	2
5:45-6:00 PM	10	2	21	0	18	1	10	0	4	0	9	3
UDY AREA PEAK OUR VOLUMES												
TAL: VEHICLES	55		83		135		53		24		113	
% TRUCKS	13%		5%		2%		0%		0%		13%	

HMM ASSOCIATES
COUNTSUM®
TRAFFIC ANALYSIS

GEOMETRY



JOB NO: 2397 TOWN/CITY: CHARLESTOWN DATE: 02/[illegible]/88

DAY OF WEEK: TUESDAY WEATHER: CLEAR RECORDERS: SHG

INTERSECTION: CHELSEA ST./THIRTEENTH ST.(GATE 5)

REMARKS:

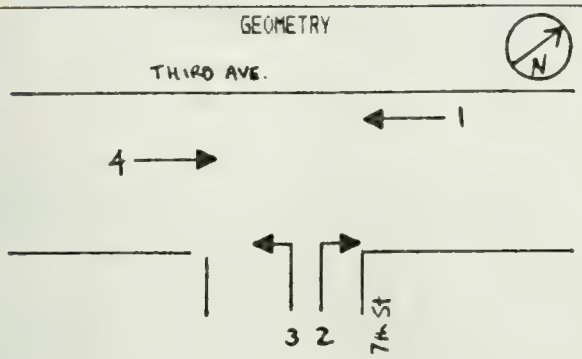
PEAK HOUR AT THIS LOCATION: 4:30-5:30 PM

PEAK HOUR FOR THE STUDY AREA: 4:30-5:30 PM

VEHICLE COUNT

	1		2		3		4		5		6	
TIME PERIOD	AUTOS	TRCKS	AUTOS	TRCKS	AUTOS	TRCKS	AUTOS	TRCKS	AUTOS	TRCKS	AUTOS	TRCKS
4:00-4:15 PM	2	4	9	2	36	1	0	0	0	0	11	5
4:15-4:30 PM	2	1	13	1	15	1	1	0	0	0	26	5
4:30-4:45 PM	2	1	8	0	54	2	1	0	1	0	6	2
4:45-5:00 PM	1	0	7	3	42	2	4	0	1	0	12	0
5:00-5:15 PM	2	0	8	2	66	2	4	0	0	0	13	0
5:15-5:30 PM	2	0	17	1	54	2	2	0	0	0	3	2
5:30-5:45 PM	0	0	5	2	26	2	1	0	1	0	9	2
5:45-6:00 PM	1	0	5	1	39	1	3	0	0	0	7	0
STUDY AREA PEAK HOUR VOLUMES												
TOTAL: VEHICLES	8		46		224		11		2		34	
% TRUCKS	13%		13%		4%		0%		0%		2%	

HMM ASSOCIATES
COUNTSUM©
TRAFFIC ANALYSIS



JOB NO: 2397 TOWN/CITY: CHARLESTOWN DATE: 02/23/88

DAY OF WEEK: TUESDAY WEATHER: RAIN RECORDERS: SHG

INTERSECTION: THIRD AVE./SEVENTH ST.

REMARKS:

PEAK HOUR AT THIS LOCATION: 4:30-5:30 PM

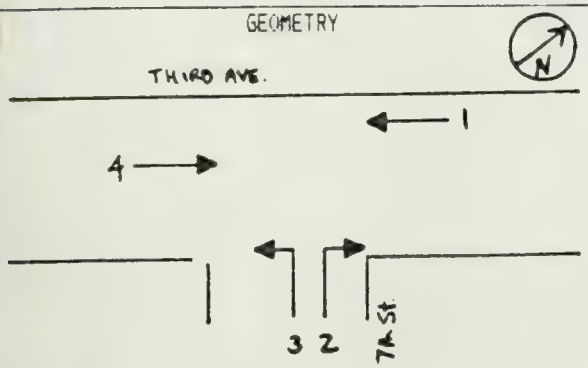
PEAK HOUR FOR THE STUDY AREA: 4:30-5:30 PM

VEHICLE COUNT

	1		2		3		4		5		6	
TIME PERIOD	AUTOS	TRCKS	AUTOS	TRCKS	AUTOS	TRCKS	AUTOS	TRCKS	AUTOS	TRCKS	AUTOS	TRCKS
4:00-4:15 PM	1	0	0	0	11	1	2	0				
4:15-4:30 PM	2	0	1	0	2	1	1	0				
4:30-4:45 PM	2	0	1	0	4	1	1	0				
4:45-5:00 PM	3	0	0	0	5	0	0	0				
5:00-5:15 PM	9	0	2	0	11	1	1	0				
5:15-5:30 PM	7	1	0	0	3	0	1	0				
5:30-5:45 PM	5	0	1	0	0	1	0	0				
5:45-6:00 PM	4	0	1	0	2	0	1	0				
STUDY AREA PEAK HOUR VOLUMES												
TOTAL: VEHICLES	22		3		25		3					
% TRUCKS		5%		0%		8%		0%				

COUNTSUM®
TRAFFIC ANALYSIS

GEOMETRY



JOB NO: 2397 TOWN/CITY: CHARLESTOWN DATE: 02/24/89

DAY OF WEEK: WEDNESDAY WEATHER: CLEAR RECORDERS: SHG

INTERSECTION: THIRD AVE./SEVENTH ST.

REMARKS:

PEAK HOUR AT THIS LOCATION: 7:45-8:45 AM

PEAK HOUR FOR THE STUDY AREA: 7:45-8:45 AM

VEHICLE COUNT

	1		2		3		4		5		6	
TIME PERIOD	AUTOS	TRCKS	AUTOS	TRCKS	AUTOS	TRCKS	AUTOS	TRCKS	AUTOS	TRCKS	AUTOS	TRCKS
7:00-7:15 AM	8	0	1	0	3	0	1	0				
7:15-7:30 AM	3	1	1	0	7	0	1	0				
7:30-7:45 AM	3	1	3	0	4	1	0	0				
7:45-8:00 AM	5	0	5	1	6	1	3	0				
8:00-8:15 AM	8	1	6	0	5	0	8	0				
8:15-8:30 AM	5	1	5	0	6	0	1	0				
8:30-8:45 AM	7	0	8	0	5	1	9	0				
8:45-9:00 AM	6	0	5	0	4	0	4	0				
STUDY AREA PEAK HOUR VOLUMES												
TOTAL: VEHICLES	27		25		24		21					
% TRUCKS		7%		4%		8%		0%				

TE CODE : 00002397
CATION : FIFTH ST. AT GATE 4
UNT SITE: CHARLESTOWN
ERATOR : HMM ASSOCIATES

PAGE: 1
FILE: NAVY2

DATE: 2/09/88

TUESDAY- 9 :	NB		SB		COMBINED		WEDNESDAY-10 :	NB		SB		COMBINED	
	AM	PM	AM	PM	AM	PM		AM	PM	AM	PM	AM	PM
2:00	*	*	*	*	*	*		7	36	9	34	16	70
2:15	*	*	*	*	*	*		5	23	4	35	9	58
2:30	*	*	*	*	*	*		4	30	3	30	7	60
2:45	*	*	*	*	*	*		5	37	4	47	9	84
1:00	*	*	*	*	*	*		1	28	5	35	6	63
1:15	*	*	*	*	*	*		1	31	1	27	2	58
1:30	*	*	*	*	*	*		0	36	3	35	3	71
1:45	*	*	*	*	*	*		0	29	1	40	1	69
2:00	*	*	*	*	*	*		1	30	0	38	1	68
2:15	*	*	*	*	*	*		0	42	0	30	0	72
2:30	*	*	*	*	*	*		2	34	2	38	4	72
2:45	*	*	*	*	*	*		1	54	3	21	4	75
3:00	*	*	*	*	*	*		1	54	5	26	6	80
3:15	*	55	*	25	*	80		0	58	0	25	0	83
3:30	*	43	*	25	*	68		0	33	1	32	1	65
3:45	*	30	*	30	*	60		0	38	0	28	0	66
4:00	*	25	*	22	*	47		1	*	1	*	2	*
4:15	*	24	*	22	*	46		1	*	0	*	1	*
4:30	*	27	*	32	*	59		2	*	1	*	3	*
4:45	*	40	*	40	*	80		2	*	0	*	2	*
5:00	*	75	*	28	*	103		1	*	3	*	4	*
5:15	*	36	*	36	*	72		2	*	5	*	7	*
5:30	*	21	*	25	*	46		4	*	11	*	15	*
5:45	*	41	*	34	*	75		3	*	19	*	22	*
6:00	*	40	*	37	*	77		7	*	34	*	41	*
6:15	*	37	*	29	*	66		7	*	41	*	48	*
6:30	*	25	*	33	*	58		16	*	38	*	54	*
6:45	*	23	*	38	*	61		18	*	32	*	50	*
7:00	*	23	*	27	*	50		14	*	20	*	34	*
7:15	*	24	*	23	*	47		33	*	32	*	65	*
7:30	*	14	*	30	*	44		35	*	26	*	61	*
7:45	*	11	*	23	*	34		23	*	38	*	61	*
8:00	*	22	*	32	*	54		40	*	41	*	81	*
8:15	*	20	*	39	*	59		39	*	55	*	94	*
8:30	*	16	*	25	*	41		38	*	39	*	77	*
8:45	*	16	*	18	*	34		33	*	54	*	87	*
9:00	*	13	*	35	*	48		37	*	45	*	82	*
9:15	*	14	*	20	*	34		23	*	46	*	69	*
9:30	*	12	*	26	*	38		27	*	32	*	59	*
9:45	*	9	*	19	*	28		32	*	37	*	69	*
0:00	*	14	*	14	*	28		23	*	23	*	46	*
0:15	*	8	*	17	*	25		37	*	34	*	71	*
0:30	*	7	*	16	*	23		31	*	33	*	64	*
0:45	*	10	*	19	*	29		35	*	28	*	63	*
1:00	*	9	*	18	*	27		24	*	21	*	45	*
1:15	*	12	*	24	*	36		33	*	40	*	73	*
1:30	*	10	*	14	*	24		33	*	28	*	61	*
1:45	*	7	*	12	*	19		46	*	36	*	82	*
	* 813		* 907		* 1720			728	593	934	521	1662	1114
AM TOTALS	813		907		1720			1321		1455		2776	
% TOTAL	* 47.3		* 52.7					43.8	53.2	56.2	46.8		
PEAK HOUR	* 4:30		* 6:00		* 4:30			8:00	2:30	8:15	12:15	8:15	2:30
VOLUME	* 178		* 137		* 314			150	200	193	147	340	310

TE CODE : 00002397
CATION : FIFTH ST. AT GATE 4
UNT SITE: CHARLESTOWN
ERATOR : HMM ASSOCIATES

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DATE: 2/08/88

	MONDAY 8		TUESDAY 9		WEDNESDAY 10		THURSDAY 11		FRIDAY 12		SATURDAY 13		SUNDAY 14		WEEK AVERAGE	
	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB
:00 AM	*	*	*	*	21	20	*	*	*	*	*	*	*	*	21	20
:00	*	*	*	*	2	10	*	*	*	*	*	*	*	*	2	10
:00	*	*	*	*	4	5	*	*	*	*	*	*	*	*	4	5
:00	*	*	*	*	1	6	*	*	*	*	*	*	*	*	1	6
:00	*	*	*	*	6	2	*	*	*	*	*	*	*	*	6	2
:00	*	*	*	*	10	38	*	*	*	*	*	*	*	*	10	38
:00	*	*	*	*	48	145	*	*	*	*	*	*	*	*	48	145
:00	*	*	*	*	105	116	*	*	*	*	*	*	*	*	105	116
:00	*	*	*	*	150	189	*	*	*	*	*	*	*	*	150	189
:00	*	*	*	*	119	160	*	*	*	*	*	*	*	*	119	160
:00	*	*	*	*	126	118	*	*	*	*	*	*	*	*	126	118
:00	*	*	*	*	136	125	*	*	*	*	*	*	*	*	136	125
:00 PM	*	*	*	*	126	146	*	*	*	*	*	*	*	*	126	146
:00	*	*	*	*	124	137	*	*	*	*	*	*	*	*	124	137
:00	*	*	*	*	160	127	*	*	*	*	*	*	*	*	160	127
:00	*	*	*	*	183	111	*	*	*	*	*	*	*	*	183	111
:00	*	*	116	116	*	*	*	*	*	*	*	*	*	*	116	116
:00	*	*	173	123	*	*	*	*	*	*	*	*	*	*	173	123
:00	*	*	125	137	*	*	*	*	*	*	*	*	*	*	125	137
:00	*	*	72	103	*	*	*	*	*	*	*	*	*	*	72	103
:00	*	*	74	114	*	*	*	*	*	*	*	*	*	*	74	114
:00	*	*	48	100	*	*	*	*	*	*	*	*	*	*	48	100
:00	*	*	39	66	*	*	*	*	*	*	*	*	*	*	39	66
	*	*	38	68	*	*	*	*	*	*	*	*	*	*	38	68
TALS	*	*	685	827	1321	1455	*	*	*	*	*	*	*	*	2006	2282

COMBINED TOTALS

:00 AM	*	*	41	*	*	*	*	41
:00	*	*	12	*	*	*	*	12
:00	*	*	9	*	*	*	*	9
:00	*	*	7	*	*	*	*	7
:00	*	*	8	*	*	*	*	8
:00	*	*	48	*	*	*	*	48
:00	*	*	193	*	*	*	*	193
:00	*	*	221	*	*	*	*	221
:00	*	*	339	*	*	*	*	339
:00	*	*	279	*	*	*	*	279
:00	*	*	244	*	*	*	*	244
:00	*	*	261	*	*	*	*	261
:00 PM	*	*	272	*	*	*	*	272
:00	*	*	261	*	*	*	*	261
:00	*	*	287	*	*	*	*	287
:00	*	*	294	*	*	*	*	294
:00	*	232	*	*	*	*	*	232
:00	*	296	*	*	*	*	*	296
:00	*	262	*	*	*	*	*	262
	*	175	*	*	*	*	*	175
	*	188	*	*	*	*	*	188
	*	148	*	*	*	*	*	148
:00	*	105	*	*	*	*	*	105
:00	*	106	*	*	*	*	*	106
OTALS	*	1512	2776	*	*	*	*	4288

TE CODE : 0000 2397
CATION : THIRTEENTH ST. AT GATE 5
UNT SITE: CHARLESTOWN
ERATOR : HMM ASSOCIATES

PAGE: 1
FILE: NAVY1

DATE: 2/09/88

TUESDAY- 9 :	NB		SB		COMBINED		WEDNESDAY-10 :	NB		SB		COMBINED	
	AM	PM	AM	PM	AM	PM		AM	PM	AM	PM	AM	PM
:00	*	*	*	*	*	*		0	11	2	28	2	39
:15	*	*	*	*	*	*		0	6	3	24	3	30
:30	*	*	*	*	*	*		0	6	0	12	0	18
:45	*	*	*	*	*	*		1	13	1	37	2	50
:00	*	*	*	*	*	*		0	8	1	37	1	45
:15	*	*	*	*	*	*		0	3	0	30	0	33
:30	*	*	*	*	*	*		0	1	0	22	0	23
:45	*	*	*	*	*	*		0	1	1	44	1	45
:00	*	*	*	*	*	*		0	2	0	40	0	42
:15	*	*	*	*	*	*		1	2	2	39	3	41
:30	*	*	*	*	*	*		1	1	0	20	1	21
:45	*	*	*	*	*	*		0	1	1	28	1	29
:00	*	*	*	*	*	*		1	7	0	54	1	61
:15	*	*	*	*	*	*		0	5	0	36	0	41
:30	*	12	*	31	*	43		0	5	0	22	0	27
:45	*	11	*	16	*	27		0	12	0	24	0	36
:00	*	22	*	16	*	38		0	19	0	23	0	42
:15	*	6	*	12	*	18		0	14	0	16	0	30
:30	*	18	*	17	*	35		0	17	0	30	0	47
:45	*	14	*	26	*	40		0	17	3	31	3	48
:00	*	25	*	27	*	52		0	26	0	22	0	48
:15	*	19	*	34	*	53		1	13	0	20	1	33
:30	*	16	*	16	*	32		0	9	4	22	4	31
	*	16	*	21	*	37		4	16	10	13	14	29
	*	8	*	10	*	18		5	10	21	20	26	30
:15	*	9	*	9	*	18		11	8	37	12	48	20
:30	*	8	*	12	*	20		8	9	18	9	26	18
:45	*	3	*	8	*	11		14	4	37	7	51	11
:00	*	6	*	1	*	7		13	2	16	8	29	10
:15	*	5	*	4	*	9		13	10	15	17	28	27
:30	*	4	*	9	*	13		31	5	23	11	54	16
:45	*	4	*	13	*	17		25	2	34	4	59	6
:00	*	6	*	16	*	22		28	3	36	15	64	18
:15	*	4	*	9	*	13		23	7	31	10	54	17
:30	*	2	*	7	*	9		28	0	28	8	56	8
:45	*	3	*	14	*	17		20	4	36	10	56	14
:00	*	4	*	9	*	13		23	4	33	3	56	7
:15	*	7	*	7	*	14		25	4	34	9	59	13
:30	*	6	*	10	*	16		8	2	11	4	19	6
:45	*	5	*	6	*	11		13	3	19	1	32	4
:00	*	2	*	5	*	7		19	5	13	5	32	10
:15	*	1	*	7	*	8		7	3	19	7	26	10
:30	*	4	*	6	*	10		10	0	38	4	48	4
:45	*	0	*	6	*	6		9	6	18	9	27	15
:00	*	4	*	9	*	13		19	1	33	4	52	5
:15	*	1	*	6	*	7		13	3	20	2	33	5
:30	*	1	*	1	*	2		13	1	18	6	31	7
:45	*	1	*	1	*	2		22	0	29	3	51	3
	* 257		* 401		* 658			409	311	645	862	1054	1173
HR TOTALS	257		401		658			720		1507		2227	
TOTAL	* 39.1		* 60.9					38.8	26.5	61.2	73.5		
EAK HOUR	* 4:30		* 4:30		* 4:30			7:30	4:15	8:00	1:30	7:45	4:30
OLUME	* 76		* 104		* 180			107	74	131	145	233	176

TE CODE : 00002397
CATION : T-IRTEENTH ST. AT GATE 5
UNT SITE: CHARLESTOWN
ERATOR : [redacted] ASSOCIATES

PAGE: 2
FILE: NAVY1
DATE: 2/11/88

	THURSDAY-11 : NB		SB		COMBINED		FRIDAY-12 : NB		SB		COMBINED	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
:00	1	*	4	*	5	*	*	*	*	*	*	*
:15	3	*	2	*	5	*	*	*	*	*	*	*
:30	1	*	2	*	3	*	*	*	*	*	*	*
:45	0	*	1	*	1	*	*	*	*	*	*	*
:00	0	*	0	*	0	*	*	*	*	*	*	*
:15	0	*	2	*	2	*	*	*	*	*	*	*
:30	0	*	3	*	3	*	*	*	*	*	*	*
:45	1	*	1	*	2	*	*	*	*	*	*	*
:00	0	*	1	*	1	*	*	*	*	*	*	*
:15	0	*	0	*	0	*	*	*	*	*	*	*
:30	0	*	0	*	0	*	*	*	*	*	*	*
:45	0	*	1	*	1	*	*	*	*	*	*	*
:00	1	*	0	*	1	*	*	*	*	*	*	*
:15	0	*	0	*	0	*	*	*	*	*	*	*
:30	0	*	0	*	0	*	*	*	*	*	*	*
:45	0	*	0	*	0	*	*	*	*	*	*	*
:00	0	*	0	*	0	*	*	*	*	*	*	*
:15	1	*	1	*	2	*	*	*	*	*	*	*
:30	0	*	0	*	0	*	*	*	*	*	*	*
:45	0	*	0	*	0	*	*	*	*	*	*	*
:00	0	*	0	*	0	*	*	*	*	*	*	*
:15	0	*	1	*	1	*	*	*	*	*	*	*
30	2	*	6	*	8	*	*	*	*	*	*	*
	5	*	7	*	12	*	*	*	*	*	*	*
	7	*	24	*	31	*	*	*	*	*	*	*
:15	6	*	36	*	42	*	*	*	*	*	*	*
:30	11	*	30	*	41	*	*	*	*	*	*	*
:45	7	*	24	*	31	*	*	*	*	*	*	*
:00	23	*	27	*	50	*	*	*	*	*	*	*
:15	5	*	15	*	20	*	*	*	*	*	*	*
:30	27	*	31	*	58	*	*	*	*	*	*	*
:45	31	*	36	*	67	*	*	*	*	*	*	*
:00	28	*	40	*	68	*	*	*	*	*	*	*
:15	21	*	28	*	49	*	*	*	*	*	*	*
:30	28	*	24	*	52	*	*	*	*	*	*	*
:45	17	*	10	*	27	*	*	*	*	*	*	*
:00	*	*	*	*	*	*	*	*	*	*	*	*
:15	*	*	*	*	*	*	*	*	*	*	*	*
:30	*	*	*	*	*	*	*	*	*	*	*	*
:45	*	*	*	*	*	*	*	*	*	*	*	*
:00	*	*	*	*	*	*	*	*	*	*	*	*
:15	*	*	*	*	*	*	*	*	*	*	*	*
:30	*	*	*	*	*	*	*	*	*	*	*	*
:45	*	*	*	*	*	*	*	*	*	*	*	*
:00	*	*	*	*	*	*	*	*	*	*	*	*
:15	*	*	*	*	*	*	*	*	*	*	*	*
:30	*	*	*	*	*	*	*	*	*	*	*	*
:45	*	*	*	*	*	*	*	*	*	*	*	*
	226	*	357	*	583	*	*	*	*	*	*	*
AY TOTALS	226		357		583		*		*		*	
TOTAL	38.8	*	61.2	*			*	*	*	*		
EAK HOUR	7:45	*	7:30	*	7:30	*	*	*	*	*	*	*
OLUME	108	*	135	*	242	*	*	*	*	*	*	*

TE CODE : 00002397
CATION : THIRTEENTH ST. AT GATE 5
UNT SITE: CHARLESTOWN
ERATOR : HMM ASSOCIATES

PAGE: 1
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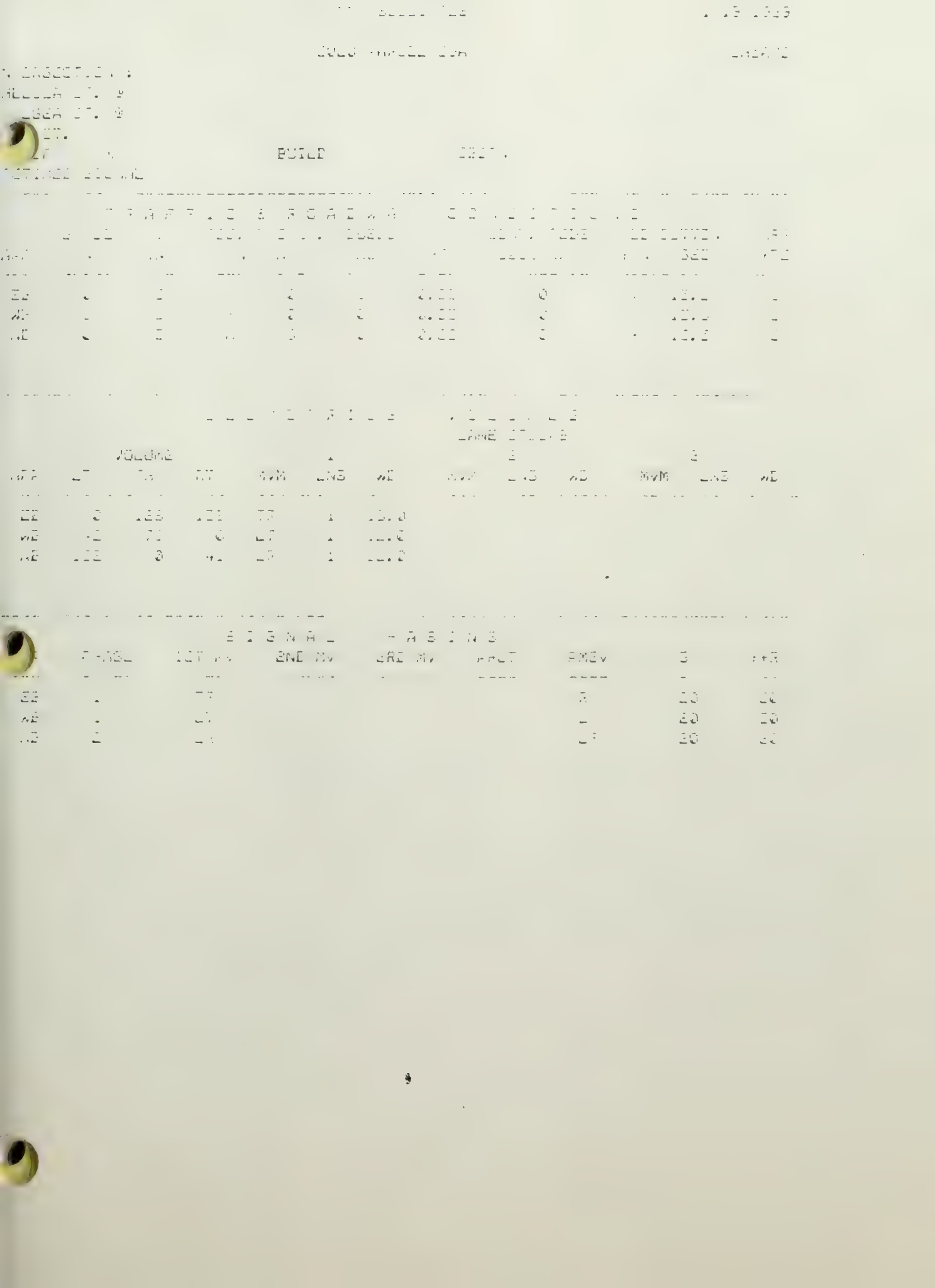
	MONDAY 8		TUESDAY 9		WEDNESDAY 10		THURSDAY 11		FRIDAY 12		SATURDAY 13		SUNDAY 14		WEEK AVERAGE	
	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB
:00 AM	*	*	*	*	1	6	5	9	*	*	*	*	*	*	3	7
:00	*	*	*	*	0	2	1	6	*	*	*	*	*	*	0	4
:00	*	*	*	*	2	3	0	2	*	*	*	*	*	*	1	2
:00	*	*	*	*	1	0	1	0	*	*	*	*	*	*	1	0
:00	*	*	*	*	0	3	1	1	*	*	*	*	*	*	0	2
:00	*	*	*	*	5	14	7	14	*	*	*	*	*	*	6	14
:00	*	*	*	*	38	113	31	114	*	*	*	*	*	*	34	113
:00	*	*	*	*	82	88	86	109	*	*	*	*	*	*	84	98
:00	*	*	*	*	99	131	94	102	*	*	*	*	*	*	96	116
:00	*	*	*	*	69	97	*	*	*	*	*	*	*	*	69	97
:00	*	*	*	*	45	88	*	*	*	*	*	*	*	*	45	88
:00	*	*	*	*	67	100	*	*	*	*	*	*	*	*	67	100
:00 PM	*	*	*	*	36	101	*	*	*	*	*	*	*	*	36	101
:00	*	*	*	*	13	133	*	*	*	*	*	*	*	*	13	133
:00	*	*	*	*	6	127	*	*	*	*	*	*	*	*	6	127
:00	*	*	*	*	29	136	*	*	*	*	*	*	*	*	29	136
:00	*	*	60	71	67	100	*	*	*	*	*	*	*	*	63	85
:00	*	*	76	98	64	77	*	*	*	*	*	*	*	*	70	87
:00	*	*	28	39	31	48	*	*	*	*	*	*	*	*	29	43
:00	*	*	19	27	19	40	*	*	*	*	*	*	*	*	19	33
:00	*	*	15	46	14	43	*	*	*	*	*	*	*	*	14	44
:00	*	*	22	32	13	17	*	*	*	*	*	*	*	*	17	24
:00	*	*	7	24	14	25	*	*	*	*	*	*	*	*	10	24
	*	*	7	17	5	15	*	*	*	*	*	*	*	*	6	16
TALS	*	*	234	354	720	1507	226	357	*	*	*	*	*	*	718	1434

COMBINED TOTALS

:00 AM	*	*	7	14	*	*	*	10
:00	*	*	2	7	*	*	*	4
:00	*	*	5	2	*	*	*	3
:00	*	*	1	1	*	*	*	1
:00	*	*	3	2	*	*	*	2
:00	*	*	19	21	*	*	*	20
:00	*	*	151	145	*	*	*	147
:00	*	*	170	195	*	*	*	182
:00	*	*	230	196	*	*	*	212
:00	*	*	166	*	*	*	*	166
:00	*	*	133	*	*	*	*	133
:00	*	*	167	*	*	*	*	167
:00 PM	*	*	137	*	*	*	*	137
:00	*	*	146	*	*	*	*	146
:00	*	*	133	*	*	*	*	133
:00	*	*	165	*	*	*	*	165
:00	*	131	167	*	*	*	*	148
:00	*	174	141	*	*	*	*	157
:00	*	67	79	*	*	*	*	72
	*	46	59	*	*	*	*	52
	*	61	57	*	*	*	*	58
:00	*	54	30	*	*	*	*	41
:00	*	31	39	*	*	*	*	34
:00	*	24	20	*	*	*	*	22
OTALS	*	588	2227	583	*	*	*	2212

APPENDIX B

TRAFFIC ANALYSIS WORKSHEETS



GOLF PARCEL 164

BUILD

| | | |

BUILD



[illegible]

[illegible]

[illegible]

EB	RESERVE CAPACITY	976	---	---
	LEVEL OF SERVICE	A		
WB	RESERVE CAPACITY	---	---	---
	LEVEL OF SERVICE			
SB	RESERVE CAPACITY	973	---	---
	LEVEL OF SERVICE	A		

LANE COUNTY

2.0 Final Soil and Foundation Investigation Report

Haley & Aldrich, Inc.

Consulting
Geotechnical Engineers,
Geologists and
Hydrogeologists

[illegible] Place
[illegible] Route 101
Bedford, NH 03102
603-472-2034

25 January 1989
File No. 6354-02

Mr. William H. Pineo
Vice President
Cygna Consulting Engineers
286 Congress Street
Boston, MA 02210

Subject: Proposed Jamestown Place Project
Parcel 39A
Boston Naval Shipyard
Charlestown, Massachusetts

Dear Bill:

As you requested during our 11 January 1989 meeting, we have reviewed the schematic design submitted for the subject project to: (1) familiarize ourselves with the overall scope of the project, and (2) determine whether geotechnical investigations which we previously conducted for the then-proposed joint development of Parcels 39A and 150 are adequate for the design development phase of the Jamestown Place Project.

Based on our review of the information you provided us, we believe that the investigations and recommendations contained in our 23 October 1987 report for Parcels 39A and 150 are directly applicable to the proposed Jamestown Place project, and the geotechnical work completed to date is adequate for project design development.

Sincerely yours,
HALEY & ALDRICH, INC.

Richard P. Stulgis
Vice President

RPS:vb/0061-04

Branch Offices
Cambridge, Massachusetts
Glastonbury, Connecticut
Portland, Maine

Affiliate
H & A of New York
Rochester, New York

REPORT ON
SUBSURFACE EXPLORATIONS AND FOUNDATION DESIGN STUDIES
PROPOSED SITE DEVELOPMENT
PARCELS 39A AND 150, BOSTON NAVAL SHIPYARD
CHARLESTOWN, MASSACHUSETTS

for

Cygna Consulting Engineers
Boston, Massachusetts

File No. 635402

October 1987

AGA

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FIGURES

APPENDICES

I. INTRODUCTION

1-01. GENERAL

This report presents the results of subsurface investigations and analyses and recommendations pertaining to the geotechnical engineering aspects of design and construction of proposed five- and ten-story towers and below grade parking on Parcels 39A and 150, in the Boston Naval Shipyard, Charlestown, Massachusetts. The general site area is shown on Figure 1, while the location of the proposed structures is shown on Figure 2.

This study was conducted for Cygna Consulting Engineers of Boston, Massachusetts in accordance with a contract dated 14 September 1987.

1-02. PURPOSE AND SCOPE

The purpose of this study was to provide foundation design criteria and geotechnical-related construction recommendations for the proposed site development. Foundation design recommendations contained in this report are based on building and subsurface parking geometries and loads provided by Cygna Consulting Engineers.

The scope of services provided by Haley & Aldrich, Inc. consisted of the following:

1. Preparation and monitoring of a design-phase program of subsurface explorations, including test borings as required to obtain subsurface information for project design.

2. Performance of laboratory tests on selected soil samples recovered from the subsurface explorations to aid in soil classification and for determination of engineering properties required for design studies.

3. Analyses related to the geotechnical engineering aspects of foundation design and construction, and preparation of recommendations for foundation types and related design criteria. These studies have included:

    - Evaluation of various foundation types for the proposed structure.

- Recommended foundation design criteria for the soil-supported foundation.
- Estimates of probable foundation settlements.
- Evaluation of a system of permanent underslab drains to relieve hydrostatic uplift pressures at the lowest parking level.
- Preparation of general requirements for protection of subgrade bearing soils and control of groundwater during construction.
- Requirements for lateral support of the excavation perimeter during construction and development of design criteria.

1-03. ELEVATION DATUM

All elevations referred to herein are in feet and referenced to the Boston Navy Yard Datum, Mean Low Water = 100.00. Mean Low Water in Boston Harbor is 4.84 ft. below National Geodetic Vertical Datum (NGVD), which is the same as USG & GS Mean Sea Level datum of 1929.

II. FIELD AND LABORATORY INVESTIGATIONS

2-01. SUBSURFACE INVESTIGATIONS

Subsurface explorations for the proposed project facilities were undertaken in two phases:

A. Phase I Program

The Phase I preliminary subsurface exploration program consisted of a total of six 2.5-in. diameter standard test borings, designated B1 through B6. The borings were conducted by John J. Boyle of Wilton, Massachusetts, during the period 29 April to 27 May and 1 to 3 June 1987. Technical monitoring of the borings was provided by Haley & Aldrich, Inc. The borings ranged in depth from 52.0 ft. to 61.5 ft. below existing site grades and terminated in very dense glacial till soils.

Groundwater observation wells were installed in completed test borings B2(OW), B4A(OW) and B6(OW) to permit monitoring groundwater levels with time. The wells consisted of machine-slotted PVC screen, with an inside diameter of 2 in. Each well was protected at ground surface by a roadway box.

B. Phase II Program

The Phase II design subsurface exploration program consisted of an additional four 2.5-in. standard test borings, designated B7 through B10. Phase II test borings were performed by Carr-Dee Corporation of Medford, Massachusetts, and monitored by a Haley & Aldrich, Inc. geologist during the period 9 to 10 June 1987. The boring ranged in depth from 57 ft. to 62 ft. below existing site grades and terminated in very dense glacial till soils.

C. Presentation of Data

Location of Phase I and II test borings are shown on Figure 2, Subsurface Exploration Location Plan. Test boring logs, prepared by the drilling subcontractors, are presented in Appendix A.

Groundwater observation well installation reports are included in Appendix B, together with well readings obtained by Haley & Aldrich.

2-02. SUPPLEMENTAL SUBSURFACE INFORMATION

Test borings have been conducted by others in conjunction with remedial foundation construction of the existing adjacent Building 39. Logs of the three borings (TB-3, TB-4, TB-5) closest to the project site are included in Appendix A, while locations of the borings are as indicated on Figure 2. Boring depths ranged from 22.0 ft. to 52.0 ft. below existing site grades.

2-03. LABORATORY SOIL TESTING

Laboratory grain size distribution tests were performed on three split-spoon samples obtained from test borings B7 and B8, to confirm visual classification and to aid in the determination of pertinent engineering properties of the glacial till. Laboratory test procedures were performed in accordance with ASTM Standards. The results of the laboratory tests are included in Appendix C.

III. SITE AND SUBSURFACE CONDITIONS

3-01. GENERAL

The project site is located on Parcels 39A and 150 at the Boston Naval Shipyard in Charlestown, Massachusetts as shown on Figures 1 and 2.

3-02. SITE CONDITIONS

General site conditions are summarized as follows:

- The footprint of the proposed underground parking structure lies directly to the north of Buildings 38 and 39, east of Third Avenue, south of Ninth Street and west of First Avenue. Second Avenue runs south and north through the middle of the site. The site is relatively flat, with existing grade at approximately El. 116.

- Parcel 150, formerly occupied by Building 150, is presently paved and in use as a parking lot. Although not encountered in the test borings, remnants of former Building 150 foundations may remain in-place and may be encountered during proposed foundation construction. A 1976 Haley & Aldrich study of existing foundation conditions in the Navy Yard indicated that former Building 150 was founded on concrete spread footings, bearing at approximately El. 114.

- It is apparent from U. S. Navy Yard drawing No. 11, "Topographic and Subsurface Map" dated 28 July 1914, that a gasoline station occupied the central portion of Parcel 39A. The possible existence of buried gasoline storage tanks and associated gasoline contaminated soil is currently under investigation by Haley & Aldrich within the scope of a separate proposal. If present, these tanks must be removed prior to proposed foundation construction.

- A previously existing addition to Building 39 encroached into the southeastern corner of the proposed building site. A substantial rubble foundation from this addition is reportedly buried below existing site grade.

- Many subsurface utilities such as natural gas, sewer and water lines and electrical ducts, both abandoned and in-use, apparently traverse the site beneath Second Avenue.

3-03. ADJACENT STRUCTURES AND UTILITIES

Building 39 is located immediately to the south of Parcel 39A, and is currently under renovation. When completed, the four-story masonary building will reportedly be used as office space, with some retail and/or restaurant facilities also possible. Recent investigations by others have indicated that many of the original wood pile foundations had seriously rotted, requiring significant underpinning to protect the structure. At the present time, installation of drilled-in, small diameter, concrete "root" piles is being completed beneath the north end of the building. The piles are being socketed about 18 ft. into the glacial till soils. The lateral extent of these battered piles is reportedly on the order of 10 ft. of so from the face of Building 39, beneath the north and west exterior building walls. The southern portion of the building is expected to remain supported on the existing wood piles.

Renovation of Building 38, which lies to the south of Parcel 150, is reportedly in the planning stages. Previous work by Haley & Aldrich has indicated that Building 38 is founded on timber piles with the bottom of pile caps at approximately El. 107. Although verification of the condition of these piles has not yet been made by the abutting owner, based on the condition of the building itself, it is understood that the piles are assumed to be in good condition and are reportedly expected to remain in-use.

Ninth Street abuts the site to the north, and is expected to remain in-use throughout the project. Many utilities apparently exist below the roadway.

3-04. SUBSURFACE SOIL CONDITIONS

Subsurface explorations conducted within the vicinity of the proposed construction indicate a subsurface soil sequence consisting of three major units. The generalized vertical sequence is as follows, in order of occurrence below ground surface:

A. Fill
B. Marine Clay
C. Glacial Till

All three units were encountered in all of the Phase I and Phase II test borings. The general relationship of these strata, interpreted from the test borings, is shown graphically on Figures 3, 4 and 5, Subsurface Profiles A-A, B-B and C-C, respectively. Local deviations from the inferred conditions should be expected.

A more detailed description of the major soil strata follows:

Fill: Miscellaneous fill was encountered in the borings in thicknesses ranging from approximately 4 ft. to 15 ft., and is the result of successive past filling in the general area and previous construction at the site. The fill typically consists of loose to dense silty sand or sandy silt with varying amounts of gravel, clay, brick and wood. The thickness of this stratum generally increases toward the southern corner of the site.

Silty Clay: Silty clay was laid down from glacial melt in the quiescent waters of the Greater Boston Basin. The stratum was encountered in thicknesses ranging from 5 ft. to 18 ft. across the site, and typically consisted of very stiff to hard, silty or fine sandy clay with trace amounts of gravel.

Glacial Till: Glacial till underlies the silty clay stratum and is typically described as a dense to very dense clayey silt to silty fine sand with varying amounts of cobbles and gravel and trace amounts of coarse to medium sand. The surface of the till generally decreases in elevation toward the southeast corner of the site. The elevation of the top of till encountered in the borings ranged from El. 107 (Boring B3) to El. 87 (Boring B7).

3-05. GROUNDWATER LEVELS

Groundwater levels recorded in observation wells B2(OW), B4(OW) and B6(OW) ranged from El. 107.4 to El. 110.4 during the period 3 June 1987 to the present. The indicated water levels were generally in the fill materials and within approximately 10 ft. of existing ground surface. The observed water levels appear to be about 2 ft. higher than reported pile cut-off elevations for wood piles supporting adjacent Building 38.

It is expected that groundwater levels within the site are influenced by both man-made and natural features. The proximity of Boston Harbor may also have an effect on the groundwater regime in the general area. It should also be expected that groundwater levels will fluctuate due to season, precipitation, temperature, and other environmental effects.

VI. FOUNDATION DESIGN STUDIES

4-01. GENERAL

Foundation design and construction must conform to the applicable provisions of the Massachusetts State Building Code. Results of foundation design analyses and recommendations consistent with the Code, are presented in this section.

4-02. PROPOSED STRUCTURES

The proposed development will consist of two towers, a ten-story tower on Parcel 39A and a five-story tower on Parcel 150. Below grade parking is planned beneath the tower structures and the remainder of the site area, with a footprint area of about 39,750 sq. ft. The building locations and layout are shown on Figure 2.

The ten-story tower (Building 39A) is approximately 13,500 sq. ft. in plan area, with column loads (including loading from the below grade parking facilities) as reported by Cygna Consulting Engineers, ranging from 145 to 654 tons. The five-story tower (Building 150) covers approximately 10,500 sq. ft. and will have column loads (including below grade parking) ranging from 147 to 551 tons. Column spacings range from 20 to 22.5 ft. for Building 39A and from 20 to 32 ft. for Building 150. Structure details have not been finalized at this time.

Three alternatives for below grade parking were initially examined consisting of two, three and four basement levels. The following conclusions were reached:

1. Two levels of underground parking would require foundation excavation to about El. 97 (See Figures 3,4 and 5). Bearing soils at bottom of excavation would range from very stiff clay to very dense till. Depending upon actual building loads, differential settlement considerations might dictate the need for more costly deeper foundation members (possibly drilled-in piers or caissons) extending through the clay to the till in areas such as the southern portion of the site. Spread footing support would be suitable where glacial till occurs at or near bearing level. It may be feasible to design the lowest parking level slab as a "relieved" slab-on-grade, but

perimeter concrete diaphragm walls would be required and would have to extend deeper into the glacial till to provide partial seepage cutoff (i.e. additional cost).

2. Three levels of underground parking would require foundation excavation to about El. 89 (See Figures 3, 4,and 5). Till would generally be encountered at bearing level, and spread footing building support is considered feasible. Several feet of over-excavation would probably be required in some areas where clay soils extend below bottom of excavation. A perimeter concrete diaphragm wall (constructed by the slurry trench method) would be required as part of the temporary lateral support system to protect adjacent Buildings 38 and 39 during construction. The diaphragm wall must be set back from Building 39, so as not to compromise the load-carrying capacity of the recently installed deeper "root" piles (See Figures 2 and 3). It is expected that the lowest level parking slab may be designed as a "relieved" slab-on-grade, assuming perimeter concrete diaphragm walls would be employed and would extend some distance below bottom of excavation into the till.

3. Four levels of underground parking would require general site excavation to a depth of approximately 36 ft. and would encounter glacial till at bottom of excavation. Foundation support and treatment of the lowest level slab would be similar to that for three levels of underground parking. Additional setback requirements would probably be required for the perimeter diaphragm wall adjacent to Building 39 in order not to compromise the load-carrying capacity of the Building 39 "root" pile foundations (See Figure 3).

Based on discussion with Cygna Consulting Engineers, three and possibly four levels of underground parking appear to satisfy desired parking requirements. Foundation design recommendations discussed hereinafter, therefore, are directed at the "three-level" alternative. Recommendations are, however, applicable to the "four-level" alternative, except for diaphragm wall setback requirements as discussed previously.

4-03. FOUNDATION DESIGN RECOMMENDATIONS
(Three Levels of Underground Parking)

A. Support of Columns and Walls

It is recommended that the proposed structures be supported on strip or spread footings bearing directly on the natural glacial till. The top of the glacial till stratum was generally encountered at or above anticipated bottom of excavation in most of the test borings. It is anticipated that in some areas, however, modest over-excavation will be required to remove deeper clay soils.

It is recommended that the footings be designed for a maximum allowable bearing pressure of 5.0 tons per square foot (tsf). For footings less than 3.0 ft. in least lateral dimension, the allowable bearing pressure should be reduced to a value determined as 1/3 of the allowable bearing pressure given above, multiplied by the least lateral dimension of the footing in feet. For example, the allowable bearing pressure for a strip footing having a width of 1.5 ft. would be 2.5 tsf. It is further recommended that the least lateral dimension of all footings be no less than 18 inches. The combined dead and live column loads, plus weight of the foundation elements, should be included in computing the contact bearing pressure.

Due to the characteristics of the dense underlying glacial till soil, any soil heave or settlement resulting from excavation and construction is expected to be well within acceptable limits. A slight elastic response of the soil will be experienced during unloading (excavation) and reloading (construction), but long term, time-dependent settlements are expected to be relatively modest (i.e. less than 1.0 inch).

B. Seismic Design Considerations

1. Liquefaction

Based on the results of the test borings, it has been concluded that the natural soil strata underlying the site are not liquefaction susceptible.

2. S (Soil) Factor

In accordance with the Massachusetts State Building Code, Section 716.4.1.3, Section 720.5, and Figure 716.1, it has been estimated that an S factor of 1.0 should be incorporated in seismic design analyses.

4-04. DESIGN RECOMMENDATIONS FOR BASEMENT WALLS AND FLOOR SLABS

A. General

Basement walls in general must be designed to resist lateral pressures due to soil, groundwater (if below the water table), earthquake induced dynamic forces, and surcharge effects from any adjacent structures which may bear at a level above the bottom of the wall. Most of these sources of pressure will be acting at some time against portions of the basement walls for the proposed building.

B. Lateral Pressures on Basement Walls

Excavation to a depth of approximately 29 ft. below existing site grades will be required during foundation construction. Additionally, the lowest planned foundation grades are approximately 25 ft. below site groundwater levels. Due to the presence of adjacent structures, roadways and utilities, it will be necessary to (1) provide an earth support system to retain the sides of the excavation, and (2) maintain the existing piezometric (groundwater) regime at the site during construction, while controlling foundation seepage.

In our opinion, controlling drawdown associated with construction dewatering, and minimizing settlement of adjacent existing facilities during excavation are of prime importance at this site. We, therefore, have recommended that a perimeter concrete diaphragm wall (cast-in-place using slurry methods) be adopted to provide temporary lateral earth support during excavation and positive cut-off against foundation seepage both for temporary (construction) and permanent (post-construction) conditions. For economy, it is also recommended that the diaphragm wall be incorporated as the permanent building foundation (basement) wall.

The concrete diaphragm wall must be designed to resist loading combinations associated with its use as a lateral support system (construction loading) and as a permanent foundation (basement) wall (permanent loading). Design loads (loading diagrams/criteria) under temporary loads imposed during excavation and permanent post-construction loads have been developed and are shown on Figure 6. See Section 5-03 for a more detailed discussion of the recommended excavation retention system (concrete diaphragm wall).

During an earthquake occurrence, additional stresses will develop against the exterior below grade walls of the structure. It is recommended that the exterior foundation walls below grade be designed to resist an earthquake force calculated in accordance with Section 716.6.10 of the Massachusetts State Building Code. This dynamic force should be distributed uniformly over the height of the wall below grade and added to the recommended static lateral pressure to establish the total exterior lateral stresses for design of the walls.

C. Floor Slab Recommendations

The lowest level floor slab will be subjected to significant hydrostatic uplift pressures corresponding to an exterior water level at El. 111.0, if not relieved. We believe that it is technically feasible to provide permanent underdrains beneath the lowest parking level floor slab to relieve uplift pressures and permit the use of a relatively thin paving slab. Due to: (1) the relatively impervious nature of the clay and glacial till soils, and (2) construction of a perimeter concrete diaphragm wall by the slurry trench method, it is our opinion that the possibility of a direct hydraulic connection between the underslab relief system and exterior groundwater levels is highly unlikely. The perimeter diaphragm-wall should extend a minimum of 10 ft. below the lowest excavation level.

Typical details and a suggested layout of the underslab drainage system are shown in Figures 7 and 8. Perforated pipe should be laid at about 40 to 50 ft. center-to-center spacings within the pervious underslab drainage layer, to direct collected water to sumps for discharge by pumping into storm drains. Permits may be required

for such discharge. The Owner should pursue this matter and obtain any necessary discharge permits prior to the start of construction.

A seepage analysis was conducted using idealized boundary conditions and soil properties to determine the quantity of seepage. It was estimated that seepage rates into the underslab drainage system would be approximately 5 gallons per minute.

The pervious underdrain material should be graded crushed stone that is hard, inert and durable. This material can be used for drainage stone and as pipe bedding. Gradation requirements for this material should conform to the MDPW's material specification M2.011.42.011.4 (3/4 in. stone).

The pump system should be redundant to allow pumping with more than one pump. Back-up systems should be provided to ensure underslab drainage is maintained in the event of pump failure or power outage. Each sump should be equipped with automatic pumps be and located a minimum of one column bay from the perimeter of the diaphragm wall. Drain lines should direct the flow toward the sumps, and cleanouts should be provided along the underdrain lines and at changes in direction. The sumps, pumps, and the associated discharge system are recommended to be sized to accommodate a flow of approximately 50 gpm.

D. Waterproofing

The lowest below-grade level will be approximately 25 ft. below design groundwater level. As a result, minor water infiltration should be expected into building areas below the groundwater level. The use of waterproofing to prevent such infiltration is generally optional and at the discretion of the Owner for "low priority" areas such as parking garages. Likely sources of water infiltration would be longitudinal joints between wall panels in the diaphragm wall and improperly sealed tieback holes.

In our opinion, leakage through the diaphragm wall should be minimal if panel joints are properly cleaned prior to concreting and tieback holes are properly sealed. As further protection, project specifications should require post-construction grouting and sealing of the diaphragm wall at any locations of leakage. In general, the

bentonite slurry "filter cake" which remains against the exterior face of the diaphragm wall can be considered as a form of waterproofing.

Waterproofing should not be required below the lowest level slab, as the underslab drainage system will relieve the piezometric pressures and maintain the local groundwater level below the slab elevation.

V. CONSTRUCTION CONSIDERATIONS

5-01. GENERAL

The primary purpose of this section of the report is to provide comments and recommendations on items related to excavation, the excavation retention system, groundwater control during construction, foundation construction and related geotechnical aspects of the proposed construction. It is written primarily for the engineer having responsibility for preparation of plans and specifications. Since it identifies potential construction problems related to foundations and earthwork, it will also aid personnel who monitor the construction activity. Prospective contractors for this project must evaluate construction problems on the basis of their own knowledge and experience in the area taking into account their proposed construction methods.

The proposed foundation construction requires a major excavation approximately 28 to 30ft. below street levels (approximately 24 to 26 ft. below design groundwater level). If a fourth level of parking is adopted, these depths are expected to be approximately 8 ft. greater. Along the perimeter, the excavation will extend to within several feet of adjacent buildings, streets and/or important utilities. The southern excavation line will be approximately 15 ft. from the existing Building 39 and 5 ft. from Building 38. Modifications of these excavation setbacks will be required should a fourth underground parking level added. Along the western and northern sides, there are existing buildings approximately 50 to 65 ft. from the proposed excavation. In view of these conditions, it is essential that careful consideration be given to the various phases of foundation construction. Detailed pre-planning and scheduling of these interrelated activities will be important.

Foundation construction must satisfy the following general requirements:

- The sides of the excavation must be supported by a stable lateral support system which will control lateral movements within tolerable limits and protect the adjacent streets, buildings and utilities from damage.

- Site excavation and dewatering must be completed in a manner which will preserve the undisturbed state of the bearing soils for the support of footings.

- All footings are to bear directly on the glacial till stratum. It is expected that over-excavation may be required in some areas of the site (especially along portions of the southern limits of excavation) to reach this bearing layer.

5-02. EXCAVATION

General excavation of the entire site is required to about El. 88, approximately 28 ft. below existing site grade. Slightly deeper excavations will be required for construction of individual footings and for placement of underslab drainage lines.

It is anticipated that general foundation excavation to within 2 to 3 ft. of design bearing levels may be made by conventional earth excavation methods. General excavation will encounter former building substructures (structural basement floor slabs, foundation walls, rubble foundations, etc.) in addition to miscellaneous fill and clay. It is not expected that the excavated materials will be suitable for re-use on the project and they should be removed from the site. Special considerations may be required with respect to the disposal of excavated soils from the site. Permits may be required and disposal may be limited to accepted seaside landfill sites if the salinity of the material is substantial. It is the responsibility of the Owner to pursue this matter and make the necessary arrangements prior to the start of construction.

The progress of excavation must be carefully considered with the scheduled program for installation and prestressing of tiebacks and internal bracing systems.

The final 2 to 3 ft. of excavation to subgrade bearing levels must be carried out with care and under controlled conditions. The following guidelines are recommended:

- Employ lightweight machines, preferably rubber-tired vehicles, if normal earth-moving equipment disturbs the bearing soils.

- Complete final excavation to bearing level with machines equipped with smooth-bladed buckets.

- The final cuts to design bearing levels for the slab and footings should be delayed as long as possible, to minimize the time during which the subgrade surfaces are exposed.

- Heavy equipment or concrete trucks should not be allowed to travel directly over exposed bearing soils.

- Any over-excavation of soils below footing bearing surfaces should be backfilled with lean concrete.

- If footings are not cast in the same day as final excavation to bearing level, a nominal 3-inch thickness of lean concrete should be placed over the bearing surfaces to serve as a "working mat" to protect against further disturbance. Exposed subgrade surfaces beneath the slab-on-grade should be covered with the required drainage no later than the end of each working day.

- A suitable dewatering system must be in operation, prior to and during final excavation to bearing level, to assure that there is no significant seepage flow into the excavation which would tend to loosen or soften the subgrade bearing soils.

5-03. EXCAVATION RETENTION SYSTEM

A. General Requirements

In order to retain the earth, groundwater, adjacent streets, utilities and other features during excavation to the required subgrade levels, a well-planned excavation retention system must be provided. Such a system consists of two components: (1) the retention system which is placed to retain the soil and water from entering the excavation; and (2) the temporary lateral support system which braces the retention system during construction. At times, the retention system is extended downward into an "impervious" stratum to provide positive cut-off against potential excessive foundation seepage.

B. Excavation Retention System

In the selection of the most appropriate excavation retention system for this project, technical aspects/parameters such as: the soil profile, soil

properties, groundwater levels, groundwater control requirements during and following construction, the presence of critical structures within the zone of influence beyond the support (retention) line, the amount of lateral movements which can be tolerated, and construction rate and efficiency were considered.

1. Flexibility. The amount of displacement which the retention system undergoes (translation, rotation about the top or the bottom) during successive stages of excavation and bracing is related in part to the relative stiffness of the materials used. Where located in close proximity to adjacent streets and utilities which are soil-supported at levels above the project excavation depths, the temporary retention system must be installed and maintained with a minimum of lateral movement. Settlement associated with lateral movements in general vary from 0.5 to 1.5 times the lateral displacements within the zone of soil immediately behind the retention system.

   This is of special interest in areas of excavation adjacent to Buildings 38 and 39. Excessive deformation and/or relief of stresses within the soil mass outside the excavation could result in unacceptable levels of settlement and/or structural distress of the wood piles (Building 38) or the recently installed underpinning system (Building 39).

2. Tightness. The ability to prevent loss of retained soil through voids and openings in the retention system is especially important at locations in close proximity to soil-supported buried structures, utilities and paved areas.

3. Seepage Cut-Off. Around the entire project perimeter, relatively pervious soils (miscellaneous fill) occur at minor depths and are underlain by more impervious clay and till strata. A retention system in the form of an impervious barrier would stop direct seepage flow from the fill stratum into the excavation. In addition, an impervious barrier penetrating below subgrade into the glacial till would minimize potential seepage gradients along the perimeter during final excavation stages. Further providing a positive cut-off, such an impervious

barrier would reduce the possibility of a direct hydraulic connection between the proposed underslab drainage system and exterior groundwater levels.

The retention system, which in our opinion will best satisfy the above discussed technical considerations, is a concrete diaphragm wall constructed by the slurry trench method. The construction techniques used for slurry trench wall construction require special expertise and rely primarily upon the experience and the equipment of the contractor engaged for this work.

The following recommendations are made relative to the significant phases of the diaphragm wall construction:

1. Pre-excavate a trench along the diaphragm wall alignment to a level below existing basement slabs and foundations, in order to remove obstructions. Replace excavated materials with compacted granular backfill or lean concrete, as preparation for the construction of guide walls to begin slurry trench excavation.

2. A reinforced concrete guide wall is required to provide proper wall alignment during excavation. These guide walls should be constructed with the top of the walls a minimum of 3 ft. above the design groundwater level (El. 111) during construction.

3. Design the entire diaphragm wall to be constructed with the top of wall at an elevation equal to the top of guide walls.

4. The toe elevation of the wall should vary, as required, to permit a minimum 10 ft. wall penetration below the proposed bottom of excavation into the glacial till stratum, thereby providing the necessary seepage cut-off. It should be expected that diaphragm wall panels will be deeper in some areas, where the top of the till stratum is somewhat lower than the proposed subgrade elevation.

5. The toe elevation of the wall should be established such that there is sufficient penetration below the bottom of excavation to (1) provide adequate soil-resistance against vertical loads (weight of

wall, vertical component of induced bracing loads, etc.) and (2) satisfy horizontal force equilibrium below the bottom of excavation. The above-described penetration requirements for seepage control should be adequate to fulfill these conditions.

C. Lateral Support System

Factors such as load capacity, lateral movements, construction efficiency and cost effectiveness were considered in the recommendation of a temporary lateral support system.

The lateral support system, which in our opinion best satisfies the previously noted considerations for this project, is a system of soil tiebacks supplemented with corner bracing and/or rakers. Tiebacks would be installed along the entire northern and portions of the eastern and western sides of the diaphragm wall. Rakers internal corner braces should be installed along the southern wall and portions of the eastern and western walls.

Inasmuch as there are several acceptable types of tiebacks and a variety of installation techniques with a range of individual tie capacities which would be considered acceptable, the contractor should be permitted to propose tieback design and installation details, within guidelines established in the contract documents, for review by the Engineer.

D. Construction Recommendations

Important construction-related guideline criteria and recommendations are summarized as follows:

1. A detailed submittal should be prepared by the Contractor for review by the Engineer. The submittal should indicate proposed tieback and bracing types and capacities; installation equipment and procedures; tieback/bracing orientation; location and geometry with respect to basement floor levels, adjacent utilities and subsurface structures; field testing and evaluation procedures; coordination with excavation; and temporary and long-term control of incoming waterflow.

2. Tieback installation procedures should prevent loss-of-ground both during and after installation.

3. Tieback installations should be accomplished through steel sleeves cast at predetermined locations in the diaphragm wall. The collar of each sleeve should be equipped with a steel bearing plate oriented parallel to the face of the wall and of sufficient size to accommodate tieback loading and to permit the welding of the tieback anchorage assembly.

4. A detail showing the proposed methods for providing temporary control of water inflow through the tieback sleeves should be developed by the Contractor and submitted for review by the Engineer. The arrangement developed may include the use of mechanical, welded or pneumatic-type sealing devices.

5. Excavation levels and lateral support system installation should be carefully coordinated and monitored to assure that excavation does not proceed to a depth greater than 2 ft. below a lateral support system member prior to the installation and prestressing of the member. The uppermost level of lateral support members should be located at a maximum depth of 8 ft. below presently existing site grade.

6. The number and spacing of tieback/bracing levels are to be determined by the Contractor based on an evaluation of the available subsurface data, anticipated tieback capacity and stiffness of the diaphragm wall. It should be noted, however, that tiebacks/bracing should not be located within 1 ft. of the top or 3 ft. below the bottom of proposed basement floor slabs such that detensioning tiebacks or removal of braces will be required to construct the floor slabs.

7. Limits to the maximum allowable lateral movement of the wall and ground surface settlement (performance criteria) will be included in the contract specifications. These movements should be monitored closely by both the Contractor and the Engineer to assure compliance with the established criteria and to reduce the risk of developing excessive displacements which may damage adjacent buildings, streets and utilities.

5-04. GROUNDWATER CONTROL

A. Temporary Control

As discussed in Section 5-03, a perimeter concrete diaphragm wall is proposed. A 10-ft. minimum embedment depth below excavation levels into the dense and relatively impervious till stratum is recommended to provide seepage cut-off against water flow into the excavation.

During general excavation to subgrade bearing levels, it is anticipated that normal open pumping methods could be used to handle water within the excavation. In addition to the anticipated small amounts of water which may seep below the cut-off, some water should be expected in the relatively pervious fill and from temporary tieback installations which are not completely sealed. Open pumping from sump holes and/or drainage ditches is expected to be adequate to permit excavation work to proceed. However, the Contractor should be prepared to install additional dewatering capacity which may become necessary to keep the excavation free of standing water and provide stable support for construction equipment.

B. Long Term Control

Long term control of groundwater flow in the completed basement levels will be primarily achieved by the concrete diaphragm wall acting as a permanent seepage barrier. Only minor amounts of water are anticipated to seep into the basement area. A summary of recommended long term groundwater control measures is as follows:

- Following detensioning of tiebacks, individual tie-back tendons should be cut off flush with the face of the diaphragm wall and steel plates should be welded to the tieback bearing plates to provide a permanent seal to groundwater flow through the tie-back sleeve.

- Minor leakage observed at the panel joints of the completed diaphragm wall should be patched with an expansive hydraulic cement.

C. Effects of Dewatering Beyond the Site

Assuming that the measures and recommendations stated in this section of the report and those provided in the specifications will be implemented, it is anticipated that there will be little lowering of the groundwater level in the immediate area surrounding the project site. Therefore, negative effects on the existing adjacent structures and facilities are not expected due to dewatering operations at the site as described above. It is recommended, however, that a sufficient number of observation wells be installed prior to construction to provide a means of monitoring water level changes. This would establish a basis for any modifications to dewatering procedures, if required.

5-05. RECOMMENDED FIELD OBSERVATIONS

It is recommended that a geotechnical engineer or technician qualified by training and experience, be present during construction to:

1. Monitor and record details of slurry wall excavation and construction.

2. Observe excavation procedures including the installation and testing of tie-back anchors and internal bracing.

3. Observe the preparation of all foundation bearing surfaces.

4. Monitor dewatering operations and adjacent groundwater levels.

It is recommended that Haley & Aldrich, Inc. be retained to provide the recommended geotechnical engineering services during construction, as well as to specify and institute a comprehensive instrumentation program to monitor lateral deformations of foundation walls, vertical and horizontal movements of adjacent structures and groundwater levels. This will enable us to observe compliance with the design concepts, specifications and recommendations, and to allow design changes in the event that subsurface conditions, induced movements or groundwater level changes differ from those anticipated prior to the start of construction.

5-06. OTHER CONSIDERATIONS

As previously noted, the building site has apparently been occupied in the past by at least three different buildings. It is also evident that many abandoned and in-use underground utilities may exist on the site. Existing utilities or foundation remnants may present obstacles to slurry wall excavation and construction. It is the responsibility of the contractor to determine the location and extent of any such obstructions. Any in-use utilities that traverse the site must be taken out of service and relocated prior to slurry wall excavation. Since the nature and extent of, and procedures for handling any such items have yet to be determined, our comments regarding geotechnical aspects of this problem will be made at a later date.

VII. LIMITATIONS OF RECOMMENDATIONS

This report has been prepared for specific application to the proposed site development and construction at Parcels 39A and 150 as understood at this time. In the event that changes in the design or location of the structures are planned, the conclusions and recommendations in this report should be reviewed and modified or verified in writing by Haley & Aldrich, Inc. Our recommendations are based in part upon the data obtained from the referenced subsurface explorations. The nature and extent of variations between explorations may not become evident until construction. If variations then appear, it may be necessary to re-evaluate the recommendations of this report.

APPENDIX A

Test Boring Logs

3.0 Final Draft Solid and Hazardous Waste Materials Report

Boring Report

Consulting Engineers
86 Congress Street
oston, Massachusetts

John J. Boyle
80 Martin Road
Milton, Mass.

TOWN Charlestown Navy Yard
PROJECT NAME Parcels 150 and 39A
PROJECT NO.

SHEET 1 OF 2
LOCATION
HOLE NO. B 1
LINE & STA.
OFFSET

GROUND WATER OBSERVATIONS
ft. after hours
0' at completion
ft. after hours

	CASING	SAMPLER	CORE BAR.
Type	Auger	SS	
Size I.D.	3 3/4"	1 3/8"	
Hammer Wt.		140#	BIT.
Hammer Fall		30"	

SURFACE ELEV. 17.75
DATE FINISH 6/3/87
BORING FOREMAN G. Taylor
INSPECTOR P. Richards
SOILS ENGR. Haley & Aldrich

LOCATION OF BORING:

tn ow face	Casing Blows per foot	Sample Depths From-To	Blows per 6" on Sampler From 0-6	6-12	To 12-18	18-24	Strata Change Depth Elev.	Field Indentification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
		0'-2'	7	12	19	29			1		
		2'-4'	19	10	9	9		Fill	2		
5'		4'-6'	15	15	18	19		(Samples taken by Haley & Aldrich)	3		
0'							10'				
		10'-12'	20	40	48	44		Very dense to dense gray-brown silt and clay, some gravel, trace of fine sand	4		
5'		15'-17'	20	18	32	17			5		
		18'-19.5'	12	13	17				6		
20'							23'				
		23'-24.5'	13	13	17			Dense coarse brown sand and gravel, trace of silt	7		
25'							25'				
		25'-27'	19	19	21	24			8		
30'		30'-32'	30	30	32	36		Dense to very dense gray silt, some clay and fine gravel, trace of sand and cobbles	9		
35'		35'-37'	16	24	35	44			10		
40'							40'				

GROUND SURFACE TO ____ FT., USED ____ " CASING; THEN ____ " CASING TO ____ FT.

C = CORED P = PIT A = AUGER UP = UNDISTURBED, PISTON

Boring Report

Consulting Engineers
o Congress Street
oston, Massachusetts

John J. Boyle
80 Martin Road
Milton, Mass.

TOWN Charlestown Navy Yard
PROJECT NAME Parcels 150 and 39A
PROJECT NO.

SHEET 2 OF 2
LOCATION
HOLE NO. B 1
LINE & STA.
OFFSET

GROUND WATER OBSERVATIONS
ft. after Hours
0' at completion
ft. after Hours

	CASING	SAMPLER	CORE BAR.
Type	Auger	SS	
Size I.D.	3 3/4"	1 3/8"	
Hammer Wt.		140#	BIT.
Hammer Fall		30"	

SURFACE ELEV. 17.75
DATE FINISH 6/3/87
BORING FOREMAN G. Taylor
INSPECTOR P. Richards
SOILS ENGR. Haley & Aldrich

LOCATION OF BORING:

th ow face	Casing Blows per foot	Sample Depths From-To	Blows per 6" on Sampler From 0-6	6-12	To 12-18	18-24	Strata Change Depth Elev.	Field Identification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
		40'-42	31	31	39	40			11		
5'		45'-47	48	48	59	62		Very dense gray silt, some clay and fine gravel, trace of fine sand	12		
0'		50'-52	38	42	49	51			13		
55'		55'-57	29	34	51	62			14		
		58'-60	31	35	40	53			15		
60'							60'	Bottom of boring 60'			

Note:
In obtaining elevation I took platform at top of steps to Morse Diesel Building - Ninth Street entrance at elevation 20.00 for bench mark.

GROUND SURFACE TO ____ FT., USED ____ "CASING; THEN ____ "CASING TO ____ FT.

C = CORED P = PIT A = AUGER UP = UNDISTURBED, PISTON

Boring Report

Consulting Engineers
00 Congress Street
oston, Massachusetts

John J. Boyle
80 Martin Road
Milton, Mass.

TOWN Charlestown Navy Yard
PROJECT NAME Parcels 150 and 39A
PROJECT NO.

SHEET 1 OF 2
LOCATION
HOLE NO. B 2
LINE & STA.
OFFSET

GROUND WATER OBSERVATIONS
ft. after Hours
10'
ft. after Hours

	CASING	SAMPLER	CORE BAR.
Type	Flush	SS	
Size I.D.	3"	1 3/8"	
Hammer wt.	400#	140#	BIT.
Hammer Fall	24"	30"	

SURFACE ELEV. 17.75
DATE FINISH 5/29/87
BORING FOREMAN G. Taylor
INSPECTOR T. Cormica
SOILS ENGR. Haley & Aldric

LOCATION OF BORING:

pth low rface	Casing Blows per foot	Sample Depths From-To	Blows per 6" on Sampler From 0-6	6-12	To 12-18	18-24	Strata Change Depth Elev.	Field Identification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
		0"-2'	2	16	22	22	2'	Dense medium to fine sand, some silt and gravel	1		
		2'-4'	11	9	8	10		Medium dense fine brown sand and silt, trace of clay	2		
5'		4'-6'	19	10	10	32	6'		3		
		6'-8'	39	25	22	27		Very dense gray-brown silt, some clay, fine sand and gravel	4		
		8'-10'	25	25	80	23	10'		5		
0'		10'-12	9	19	20	20		Hard yellow clay, some silt and gravel, trace of fine sand	6		
15'		15'-17	15	15	20	25	20'		NR		
20'		20'-22	11	12	13	21		Dense to very dense gray clay, some silt and gravel, trace of fine sand	7		
25'		25'-27	20	43	14	22			8		
30'		30'-32	9	13	28	23			9		
35'		35'-37	20	20	30	35			10		
40'							40'				

GROUND SURFACE TO ____ FT., USED ____" CASING; THEN ____" CASING TO ____ FT.

— — — U — Undisturbed C = CORED P = PIT A = AUGER UP = UNDISTURBED, PISTON

Boring Report

Consulting Engineers
6 Congress Street
ston, Massachusetts

John J. Boyle
80 Martin Road
Milton, Mass.

TOWN Charlestown Navy Yard
PROJECT NAME Parcels 150 and 93A
PROJECT NO.

SHEET 2 OF 2
LOCATION
HOLE NO. B 2
LINE & STA.
OFFSET

GROUND WATER OBSERVATIONS
ft. after hours
10'
ft. after hours

	CASING	SAMPLER	CORE BAR.
Type	Flush	SS	
Size I.D.	3"	1 3/8"	
Hammer Wt.	400#	140#	BIT.
Hammer Fall	24"	30"	

SURFACE ELEV. 17.75
DATE FINISH 5/29/87
BORING FOREMAN G. Taylor
INSPECTOR T. Cormican
SOILS ENGR. Haley & Aldrich

LOCATION OF BORING:

th ow face	Casing Blows per foot	Sample Depths From-To	Blows per 6" on Sampler From 0-6	To 6-12	12-18	18-24	Strata Change Depth Elev.	Field Identification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
		40'-42'	49	38	48	50			NR		
5'		45'-47'	40	55	85	90			11		
		50'-52'	10	15	38	49		Very dense gray silt, some fine to coarse gravel, trace of clay and fine sand	12		
5'		55'-57'	40	50	66	120 for 2"			13		
60'		60'-61.5'	34	42	120	for 5"	61.5'		14		

Bottom of boring 61.5'

Installed 2" PVC well at 15'
Used:
10'-2" PVC screen
5'-2" PVC pipe
3 bags sand
bentonite
Lock type gate box
Set in concrete

GROUND SURFACE TO ____ FT., USED ____ " CASING; THEN ____ " CASING TO ____ FT.

C = CORE B = PIT A = AUGER UP = UNDISTURBED, PISTON

Boring Report

ma Consulting Engineers
Concress Street
Boston, Massachusetts

John J. Boyle
80 Martin Road
Milton, Mass.

TOWN Charlestown Navy Yard
PROJECT NAME Parcels 150 and 39A
PROJECT NO.

SHEET 1 OF 2
LOCATION
HOLE NO. B 3
LINE & STA.
OFFSET

GROUND WATER OBSERVATIONS
at ft. after Hours
at ft. after Hours

	CASING	SAMPLER	CORE BAR.
Type	BW	SS	
Size I.D.	2½"	1 3/8"	
Hammer Wt.	400#	140#	BIT.
Hammer Fall	24"	30"	

SURFACE ELEV. 18.45
DATE FINISH 4/29/37
BORING FOREMAN G. Taylor
INSPECTOR R. Varnum
SOILS ENGR. Haley & Aldrich

LOCATION OF BORING:

Depth Below Surface	Casing Blows per Foot	Sample Depths From-To	Blows per 6" on Sampler From 0-6	From 6-12	To 12-18	To 18-24	Strata Change Depth Elev.	Field Identification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
		0'-2'	3	9	21	21	2'	Top soil and sub soil	1		
		2'-4'	12	8	8	7	4'	Sandy brown clay fill	2		
5'		4'-6'	12	14	21	24		Hard sandy brown clay	3		
10'		10'-12'	24	34	34	28	15'		4		
15'		15'-17'	22	24	58	22			5		
20'		20'-22'	9	11	14	22			6		
25'		25'-27'	24	25	35	37		Compact to very compact fine gray-brown sand, gravel, silt and clay (till)	7		
30'		30'-32'	20	22	31	38			8		
35'		35'-37'	22	23	30	34			9		
40'							40'				

GROUND SURFACE TO FT., USED "CASING; THEN "CASING TO FT.

D = DRY W = WASHED C = CORED P = PIT A = AUGER UP = UNDISTURBED, PISTON

Boring Report

[illegible] Engineers
[illegible] Congress Street
[illegible]ton, Massachusetts

John J. Boyle
80 Martin Road
Milton, Mass.

TOWN Charlestown Navy Yard
PROJECT NAME Parcels 150 and 39A
PROJECT NO.

SHEET 2 OF 2
LOCATION
HOLE NO. B 3
LINE & STA.
OFFSET

GROUND WATER OBSERVATIONS
___ ft. after ___ Hours
___ ft. after ___ Hours

	CASING	SAMPLER	CORE BAR.
Type	BW	SS	
Size I.D.	2½"	1 3/8"	
Hammer Wt.	400#	140#	BIT.
Hammer Fall	24"	30"	

SURFACE ELEV.
DATE FINISH 5/27/87
BORING FOREMAN C. Taylor
INSPECTOR T. Cormican
SOILS ENGR. Haley & Aldrich

LOCATION OF BORING:

Casing Blows per foot	Sample Depths From-To	Blows per 6" on Sampler From 0-6	6-12	To 12-18	18-24	Strata Change Depth Elev.	Field Identification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
	40'-41"	86	100					10		
							Very compact fine gray sand, gravel, silt and clay			
	45'-47"	18	22	28	34			11		
						50'				
	50'-52'	30	40	120				12		
							Cemented gray silt, some gravel, trace of fine sand and clay			
	55'-57"							NR		
	58'-60"	24	71	97	87			13		
						60'				
							Bottom of boring 60'			

GROUND SURFACE TO ___ FT., USED ___ "CASING; THEN ___ "CASING TO ___ FT.

D = DRY W = WASHED C = CORED P = PIT A = AUGER UP = UNDISTURBED, PISTON

Boring Report

Consulting Engineers
86 Congress Street
oston, Massachusetts

John J. Boyle
80 Martin Road
Milton, Mass.

TOWN Charlestown Navy Yard
PROJECT NAME Parcels 150 and 39A
PROJECT NO.

SHEET 1 OF 2
LOCATION
HOLE NO. B 4
LINE & STA.
OFFSET

GROUND WATER OBSERVATIONS
t ft. after Hours
6.7'
t ft. after Hours

	CASING	SAMPLER	CORE BAR.
Type	Auger	SS	
Size I.D.	3 3/4"	1 3/8"	
Hammer wt.		140#	BIT.
Hammer Fall		30"	

SURFACE ELEV. 17.62
DATE FINISH 6/2/87
BORING FOREMAN R. Jones
INSPECTOR T. Cormican
SOILS ENGR. Haley & Aldrich

LOCATION OF BORING:

pth low rface	Casing Blows per foot	Sample Depths From-To	Blows per 6" on Sampler From To 0-6	6-12	12-18	18-24	Strata Change Depth Elev.	Field Identification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
								4" Concrete			
	0.5	0'-2.5'	5	20	25	13		Dense black-brown fine to medium sand, some gravel, trace of wood	1	24	14
5'	2.5	2.5'-3.5'	55	61	120-0"			Very dense brown fine sand and silt, trace of gravel	2	12	8
		5'-7'	6	5	4	16		Loose dark brown fine to medium sand, some silt, trace of gravel	3	24	7
		7'-9'	30	41	80	14		Very dense brown silt, some fine sand and gravel	4	24	10
10'		9'-11'	11	24	36	34		Dense black fine sand, some silt, gravel and wood	5	24	12
		11'-13'	19	19	6	4	13'	"A"	6	24	18
		13'-15'	9	11	15	24		Very stiff brown silty clay	7	24	20
15'		18'-20'	6	9	11	14		Very stiff brown cilty clay	8	24	20
20'		23'-25'	6	7	10	11		Very stiff brown silty clay, trace of gravel	9	24	10
25'							27'				
		28'-30'	13	28	22	25		Dense gray silt and clay, trace of fine gravel and sand	10	24	15
30'							33'				
		33'-34.5'		25	48	57		Very dense gray silt, some gravel, trace of fine sand and clay	11	18	3
35'		38'-39'	28	140				Very dense gray silt, some clay and gravel, trace of fine sand	12	12	10
40'											

GROUND SURFACE TO FT., USED "CASING

"A"-Very dense black fine sand and gravel, some silt, trace of wood

= CORED P = PIT

Boring Report

onsulting Engineers
6 Congress Street
ston, Massachusetts

John J. Boyle
80 Martin Road
Milton, Mass.

TOWN Charlestown Navy Yard
PROJECT NAME Parcels 150 and 39A
PROJECT NO.

SHEET 2 OF 2
LOCATION
HOLE NO. B 4
LINE & STA.
OFFSET

GROUND WATER OBSERVATIONS
ft. after Hours
6.7'
ft. after Hours

	CASING	SAMPLER	CORE BAR.
Type	Auger	SS	
Size I.D.	3 3/4"	1 3/8"	
Hammer wt.		140#	BIT.
Hammer Fall		30"	

SURFACE ELEV. 17.62
DATE FINISH 6/2/87
BORING FOREMAN R. Jones
INSPECTOR T. Cormican
SOILS ENGR. Haley & Aldrich

LOCATION OF BORING:

th ow face	Casing Blows per foot	Sample Depths From-To	Blows per 6" on Sampler From 0-6	6-12	To 12-18	18-24	Strata Change Depth Elev.	Field Identification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
		43'-44.5'	25	31	43			Very dense gray silt, some clay and gravel, trace of fine sand	13	18	8
5'							48'				
		48'-49.5'	33	48	57				14	18	9
		53'-54.5'	34	42	91				NR	18	0
5'								Very dense gray silt, some gravel, trace of fine sand and clay			
		58.5'-60'	46	59	66				15	18	10
0'							60'				
								Bottom of boring 60'			

GROUND SURFACE TO FT., USED "CASING; THEN "CASING TO FT.

C = CORED P = PIT A = AUGER UP = UNDISTURBED, PISTON

Boring Report

onsulting Engineers
86 Congress Street
oston, Massachusetts

John J. Boyle
80 Martin Road
Milton, Mass.

TOWN Charlestown Navy Yard
PROJECT NAME Parcels 150 and 39A
PROJECT NO.

SHEET 1 OF 1
LOCATION
HOLE NO. B 4A
LINE & STA. 1' from B 4
OFFSET

GROUND WATER OBSERVATIONS
ft. after Hours
ft. after Hours

	CASING	SAMPLER	CORE BAR.
Type	Auger		
Size I.D.	3 3/4"		
Hammer Wt.			BIT.
Hammer Fall			

SURFACE ELEV. 17.62
DATE FINISH 6/2/87
BORING FOREMAN R. Jones
INSPECTOR T. Cormican
SOILS ENGR.

LOCATION OF BORING:

Depth Flow Surface	Casing Blows per foot	Sample Depths From-To	Blows per 6" on Sampler From-To 0-6	6-12	12-18	18-24	Strata Change Depth Elev.	Field Indentification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
								Auger			
5'								No sampling			
							15'				
15'								Bottom of well 15' Installed 2" well at 15' Used: 10' screen 2" PVC 5' - 2" PVC pipe 6 Bags of sand 15 lbs. pelletts 1 Road box (lock type) set in concrete			

GROUND SURFACE TO ____ FT., USED ____ "CASING; THEN ____ "CASING TO ____ FT.

C = CORED P = PIT A = AUGER UP = UNDISTURBED, PISTON

Boring Report

Consulting Engineers
86 Congress Street
Boston, Massachusetts

John J. Boyle
80 Martin Road
Milton, Mass.

TOWN Charlestown Navy Yard
PROJECT NAME Parcels 150 and 39A
PROJECT NO.

SHEET 1 OF 2
LOCATION
HOLE NO. B 5
LINE & STA.
OFFSET

GROUND WATER OBSERVATIONS
t ____ ft. after ____ Hours
t ____ ft. after ____ Hours

	CASING	SAMPLER	CORE BAR.
Type	Auger	SS	
Size I.D.	3 3/4"	1 3/8"	
Hammer Wt.		140#	BIT.
Hammer Fall		30"	

SURFACE ELEV. 17.55
DATE FINISH 6/3/87
BORING FOREMAN R. Jones
INSPECTOR P. Richards
SOILS ENGR. Haley & Aldrich

LOCATION OF BORING:

Depth Flow Surface	Casing Blows per foot	Sample Depths From-To	Blows per 6" on Sampler From 0-6	From 6-12	To 12-18	To 18-24	Strata Change Depth Elev.	Field Identification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
		0"-2'	2	10	20	23		Dense brown fine sand, some gravel, trace of silt	1	24	8
		2'-4'	48	42	30	19		Very dense miscellaneous fill, red brick concrete	2	24	4
5'		4'-6'	12	4	5	5		Loose brown silt, some fine sand and gravel, trace of red bricks & clay	3	24	9
		6'-8'	5	5	2	1		Loose brown silt, some gravel, trace of wood	4	24	7
		8'-9'	2	6				Loose gray fine sand, silt, some clay and wood	5	12	6
		9'-10'	10	16			"A"		5A	12	8
		10'-11'	7	5			11'	"B"	6	12	12
		11'-12'	13	19				Very hard brown silty clay	6A	12	5
15'		15'-17'	12	13	14	14		Very stiff brown silty clay	7	24	24
20'		20'-22'	7	7	8	10	24.5'		8	24	24
25'		25'-27'	5	11	14	15		Very dense gray silt, some clay and gravel, trace of fine sand	9	24	12
30'		30'-32	9	16	25	27			10	24	13
35'		35'-37	9	14	18	20	35'	Dense gray silt, some gravel, trace of fine sand and clay	11	24	1
40'											

GROUND SURFACE TO ____ FT., USED ____

"A"-Very stiff brown-blue silty clay .
"B"-Medium dense black fine sand and silt, som

C = CORED B = BIT

Boring Report

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... Congress Street
...ston, Massachusetts

John J. Boyle
80 Martin Road
Milton, Mass.

TOWN Charlestown Navy Yard
PROJECT NAME Parcels 150 and 39A
PROJECT NO.

SHEET 2 OF 2
LOCATION
HOLE NO. B 5
LINE & STA.
OFFSET

GROUND WATER OBSERVATIONS
___ ft. after ___ Hours
___ ft. after ___ Hours

	CASING	SAMPLER	CORE BAR.
Type	AUGER	SS	
Size I.D.	3 3/4"	1 3/8"	
Hammer Wt.		140#	BIT.
Hammer Fall		30"	

SURFACE ELEV. 17.55
DATE FINISH 6/3/87
BORING FOREMAN R. Jones
INSPECTOR P. Richards
SOILS ENGR. Haley & Aldrich

LOCATION OF BORING:

...h ...w ...ace	Casing Blows per foot	Sample Depths From-To	Blows per 6" on Sampler From 0-6	6-12	To 12-18	18-24	Strata Change Depth Elev.	Field Identification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
		40'-42'	25	20	30	33			12	24	10
		45'-46.5"	22	39	51			Very dense gray silt, some clay and gravel, trace of fine sand	13	18	9
		50'-52.5"	18	20	48				14	18	6
		55'-56.5"	17	20	64				15	18	15
		58.5'-60"	30	32	68		60'		16	18	14
								Bottom of boring 60'			

GROUND SURFACE TO ___ FT., USED ___" CASING; THEN ___" CASING TO ___ FT.

... = ... C = CORED P = PIT A = AUGER UP = UNDISTURBED, PISTON

Boring Report

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...Congress Street
...ton, Massachusetts

John J. Boyle
80 Martin Road
Milton, Mass.

TOWN Charlestown Navy Yard
PROJECT NAME Parcels 150 and 39A
PROJECT NO.

SHEET 1 OF 2
LOCATION
HOLE NO. B 6
LINE & STA.
OFFSET

GROUND WATER OBSERVATIONS
...ft. after ... Hours
1" - 8:00 A.M. - 5/4/87
...ft. after ... Hours

	CASING	SAMPLER	CORE BAR.
Type	Hollow Stem Auger	SS	
Size I.D.	3 3/4"	1 3/8"	
Hammer Wt.	—	140#	BIT.
Hammer Fall	—	30"	

SURFACE ELEV. 18.65
DATE FINISH 4/29/87
BORING FOREMAN J. Marks
INSPECTOR R. Varnum
SOILS ENGR. Haley & Aldrich

LOCATION OF BORING:

Casing Blows per foot	Sample Depths From-To	Blows per 6" on Sampler From To 0-6	6-12	12-18	18-24	Strata Change Depth Elev.	Field Identification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
	1'-3'	5	7	9	11		Mixed fill	1		12"
	3'-5'	10	12	16	18	5'		2		10"
	5'-7'	14	16	19	22	7'	Sandy gray clay, some peat and fill	3		12"
	7'-9'	15	18	21	27			4		12"
	10'-12'	6	10	19	21		Hard sandy brown clay	5		18"
	15'-17'	5	10	13	18			6		24"
	20'-22'	6	10	12	12			7		24"
						25'6"				
	25'6"-27'6"	14	20	34	37			8		14"
	30'-32'	13	29	46	25		Very compact fine gray-brown sand, gravel and silt, some clay (till)	9		20"
	35'-37'	18	34	40	73			10		22"

GROUND SURFACE TO ... FT., USED ... "CASING; THEN ... "CASING TO ... FT.

Boring Report

onsulting Engineers
Congress Street
ston, Massachusetts

John J. Boyle
80 Martin Road
Milton, Mass.

TOWN Charlestown Navy Yard
PROJECT NAME Parcels 150 and 39A
PROJECT NO.

SHEET 2 OF 2
LOCATION
HOLE NO. B 6
LINE & STA.
OFFSET

GROUND WATER OBSERVATIONS
ft. after Hours
-1" - 8:00 A.M. - 5/4/87
ft. after Hours

	CASING	SAMPLER	CORE BAR.
Type	Hollow Stem Auger	SS	
Size I.D.	3 3/4"	1 3/8"	
Hammer Wt.	—	140#	BIT.
Hammer Fall	—	30"	

SURFACE ELEV. 18.65
DATE FINISH 4/29/87
BORING FOREMAN J. Marks
INSPECTOR R. Varnum
SOILS ENGR. Haley & Aldrich

LOCATION OF BORING:

ce	Casing Blows per foot	Sample Depths From-To	Blows per 6" on Sampler From To 0-6	6-12	12-18	18-24	Strata Change Depth Elev.	Field Identification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
		40'-42'	21	30	47	51			11		20"
'		45'-47'	56	90	95	110		Very compact fine gray-brown sand, gravel and silt, some clay (till)	12		22"
		50'-52'	31	46	87	120			13		
							52'				
5'								Bottom of boring 52' (Refusal material)			
								Installed 15' long (10 slot) 2" diameter PVC monitor well screen at 35'. Packed with filter sand and sealed at top with bentonite. Encased in Buffalo Box for protection and set in concrete.			

GROUND SURFACE TO FT., USED "CASING; THEN "CASING TO FT.

CARR-DEE CORP.

37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone 391-4500

To HALEY & ALDRICH, INC., CAMBRIDGE, MA. 02142 Date June 26, 1987 Job No 87475

Location CHARLESTOWN NAVY YARD, CHARLESTOWN, MASS. Scale 1" = 3 ft.

BORING B7

GROUND SURFACE

FILL	4 10 13 13	S#1, FROM G.S. TO 2'0" RECOVERED 6"
SAND, GRAVEL, COBBLES, BRICK	20 8 17 11	S#2, FROM 2'0" TO 4'0" RECOVERED 10"
	3 5 4 3	S#3, FROM 5'0" TO 7'0" RECOVERED 9"
	6 11 20 24	S#4, FROM 7'0" TO 9'0" RECOVERED 8"
10'0"		
VERY STIFF	8 9 13 15	S#5, FROM 10'0" TO 12'0" RECOVERED 7"
YELLOW CLAY AND GRAVEL	10 7 13 15	S#6, FROM 15'0" TO 17'0" RECOVERED 8"
	19 13 14 16	S#7, FROM 20'0" TO 22'0" RECOVERED 8"
23'0"		

(CONTINUED ON SHEET 2)

CARR-DEE CORP.
37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone 391-4500

To HALEY & ALDRICH, INC, CAMBRIDGE, MA. 02142 Date JUNE 26, 1987 Job No 87475

Location CHARLESTOWN NAVY YARD, CHARLESTOWN, MA. Scale 1" = 3 ft.

BORING B 7 (CONTINUED)

23'0"			
	STIFF		
	BLUE CLAY,	6 5	S#8, FROM 25'0" TO 27'0" RECOVERED 10"
		5	
	SOME GRAVEL	6	
28'6"			
	VERY STIFF	12 11	S#9, FROM 30'0" TO 32'0" NO RECOVEREY
		19	
		14	
	CLAYEY FINE		
	SAND, GRAVEL,		
		21	S#10, FROM 35'0" TO 37'0"
		19	RECOVERED 9"
		19	
	COBBLES	20	
	VERY DENSE	15	S#11, FROM 40'0" TO 42'0"
		18	RECOVERED 15"
	FINE TO MEDIUM	33	
		44	
	SAND, GRAVEL,		
	CLAY, TRACE		
	SILT	25	S#12, FROM 45'0" TO 47'0"
		30	RECOVERED 13"
		46	
		57	
48'0"			

(CONTINUED ON SHEET 3)

CARR-DEE CORP.
37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone 391-4500

To HALEY & ALDRICH, INC, CAMBRIDGE, MA. 02142 Date JUNE 26, 1987 Job No 87475

Location CHARLESTOWN NAVY YARD, CHARLESTOWN, MA. Scale 1" = 3 ft.

BORING B 7 (CONTINUED)

48'0"			
	VERY DENSE	16	S# 13, FROM 50'0" TO 52'0"
		25	RECOVERED 8"
		81	
		50	
	FINE TO MEDIUM		
	SAND, GRAVEL,		
		27	S# 14, FROM 55'0" TO 57'0"
		38	RECOVERED 10"
		59	
	CLAY, TRACE	71	
	SILT		
		31	S# 15, FROM 60'0" TO 62'0"
		43	RECOVERED 7"
		58	
62'0"		71	

WATER LEVEL NOT RECORDED
SIZE OF CASING NW, LENGTH 12'0"
DRILLER: L. KNOX, INSPECTOR: P. RICHARDS
DATE STARTED & COMPLETED: 6-10-87

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in right hand column indicate number of blows required to drive two-inch split sampler 6 inches using 140 lb. weight falling 30 inches ±. Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 30" weight falling 24 inches ±.

CARR-DEE CORP.

37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone 391-4500

To HALEY & ALDRICH, INC, CAMBRIDGE, MA. 02142 Date JUNE 26, 1987 Job No 87475

Location CHARLESTOWN NAVY YARD, CHARLESTOWN, MA. Scale 1" = 3 ft.

BORING B 8

GROUND SURFACE

	FILL LOAM, SAND, GRAVEL, COBBLES, BRICK, ASH, CONCRETE	1 4 18 30	S#1, FROM G.S. TO 2'0" RECOVERED 8"
		16 13 11 5	S#2, FROM 2'0" TO 4'0" RECOVERED 6"
		3 3 5 6	S#3, FROM 4'0" TO 6'0" RECOVERED 6"
		7 11 14 14	S#4, FROM 6'0" TO 8'0" RECOVERED 7"
		12 13 15 11	S#5, FROM 8'0" TO 10'0" RECOVERED 18"
10'0"	VERY STIFF YELLOW CLAY AND GRAVEL	6 8 11 13	S#6, FROM 10'0" TO 12'0" RECOVERED 12"
15'0"	HARD YELLOW CLAY, GRAVEL, COBBLES	16 32 39 47	S#7, FROM 15'0" TO 17'0" RECOVERED 12"
		12 19 17 11	S#8, FROM 20'0" TO 22'0" RECOVERED 12"
24'0"			

(CONTINUED ON SHEET 2)

CARR-DEE CORP.
37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone 391-4500

To HALEY & ALDRICH, INC, CAMBRIDGE, MA. 02142 Date JUNE 26, 1987 Job No 87475

Location CHARLESTOWN NAVY YARD, CHARLESTOWN, MA. Scale 1" = 3 ft.

BORING B8 (CONTINUED)

24'0"		
	VERY STIFF	8 S#9, FROM 25'0" TO 27'0"
		11 RECOVERED 9"
	YELLOW CLAY,	13
		19
	GRAVEL, COBBLES	
		13 S#10, FROM 30'0" TO 32'0"
		18 RECOVERED 6"
	DENSE TO	20
		26
	VERY DENSE	
		17 S#11, FROM 35'0" TO 37'0"
		17 RECOVERED 5"
	FINE TO MEDIUM	33
		49
	SAND, GRAVEL,	
		15 S#12, FROM 40'0" TO 42'0"
		19 RECOVERED 5"
	COBBLES, SOME	30
		33
	CLAY AND SILT	
		21 S#13, FROM 45'0" TO 47'0"
		36 RECOVERED 7"
		39
		81
48'0"		

(CONTINUED ON SHEET 2)

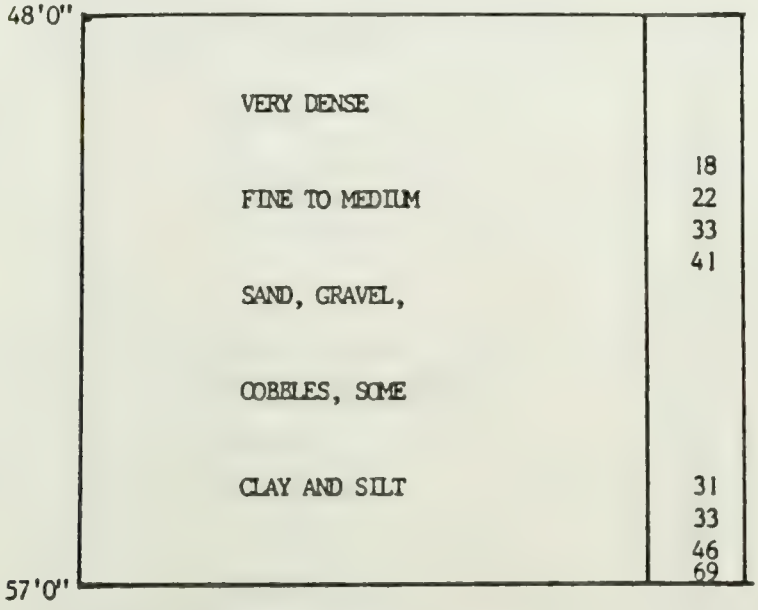
CARR-DEE CORP.

37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone 391-4500

To HALEY & ALDRICH, INC, CAMBRIDGE, MA. 02142 Date JUNE 26, 1987 Job No 87475

Location CHARLESTOWN NAVY YARD, CHARLESTOWN, MA. Scale 1" = 3 ft.

BORING B 8 (CONTINUED)



S# 14, FROM 50'0" TO 52'0"
RECOVERED 4"

S# 15, FROM 55'0" TO 57'0"
RECOVERED 8"

WATER LEVEL 8'6"
SIZE OF CASING NW, LENGTH 10'0"
DRILLER: L. KNOX, INSPECTOR: P. RICHARDS
DATE STARTED & COMPLETED: 6-9-87

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in right hand column indicate number of blows required to drive two-inch split sampler 6 inches using 140 lb. weight falling 30 inches ±. Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches ±

CARR-DEE CORP.
37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone 391-4500

To HALEY & ALDRICH, INC, CAMBRIDGE, MA. 02142 Date JUNE 26, 1987 Job No 87475

Location CHARLESTOWN NAVY YARD, CHARLESTOWN, MA. Scale 1" = 3 ft.

BORING B 9

GROUND SURFACE

0'6"	ASPHALT		
	FILL	5 30 58 60	S#1, FROM 0'6" TO 2'6" RECOVERED 14"
		36 32 25 15	S#2, FROM 2'6" TO 4'6" RECOVERED 9"
5'6"		7 8	S#3, FROM 4'6" TO 5'6" RECOVERED 6"
	VERY STIFF TO HARD YELLOW CLAY	9 15 18 21 23 29	S#3A, FROM 5'6" TO 6'6" RECOVERED 7" S#4, FROM 6'6" TO 8'6" RECOVERED 9"
	VERY STIFF YELLOW CLAY	9 9 11 14	S#5, FROM 8'6" TO 10'6" RECOVERED 7"
12'0"	DENSE FINE TO MEDIUM SILTY SAND AND GRAVEL, SOME YELLOW CLAY	23 20 22 24 9 16 17 18	S#6, FROM 15'0" TO 17'0" RECOVERED 9" S#7, FROM 20'0" TO 22'0" RECOVERED 4"
25'0"			

(CONTINUED ON SHEET 2)

CARR-DEE CORP.

37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone 391-4500

To HALEY & ALDRICH, INC, CAMBRIDGE, MA. 02142 Date JUNE 26, 1987 Job No 87475

Location CHARLESTOWN NAVY YARD, CHARLESTOWN, MA. Scale 1" = 3 ft.

BORING B 9 (CONTINUED)

25'0"			
		14	S#8, FROM 25'0" 27'0"
		14	RECOVERED 10"
		17	
	DENSE	19	
	FINE TO MEDIUM		
		13	S#9, FROM 30'0" TO 32'0"
	SILTY SAND	18	RECOVERED 2"
		16	
		21	
	AND GRAVEL,		
	SOME YELLOW CLAY		
		11	S#10, FROM 35'0" TO 37'0"
		13	RECOVERED 11"
		18	
		23	
	VERY DENSE		
		15	S#11, FROM 40'0" TO 42'0"
	FINE TO MEDIUM	25	RECOVERED 2"
		37	
		19	
	SAND AND GRAVEL,		
	SOME YELLOW		
		28	S#12, FROM 45'0" TO 47'0"
	CLAY	32	RECOVERED 2"
		29	
		34	
48'0"			

(CONTINUED ON SHEET 3)

CARR-DEE CORP.
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To HALEY & ALDRICH, INC, CAMBRIDGE, MA. 02142 Date JUNE 26, 1987 Job No 87475

Location CHARLESTOWN NAVY YARD, CHARLESTOWN, MA. Scale 1" = 3 ft.

BORING B 9 (CONTINUED)

48'0"			
	VERY DENSE	80 120/2"	S#13, FROM 50'0" TO 50'8" RECOVERED 7"
	FINE TO MEDIUM		
	SAND AND GRAVEL,		
		48 55 44	S#14, FROM 55'0" TO 57'0" RECOVERED 12"
	SOME YELLOW	49	
	CLAY		
		35 60 57 134	S#15, FROM 60'0" TO 62'0" RECOVERED 11"
62'0"			

NO WATER ENCOUNTERED
SIZE OF CASING NW, LENGTH 8'6"
DRILLER: K. KNOX, INSPECTOR: P. RICHARDS
DATE STARTED & COMPLETED: 6-9-87, 6-10-87

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in right hand column indicate number of blows required to drive two-inch split sampler 6 inches using 140 lb. weight falling 30 inches ±. Figures in column to left (if noted) indicate number of blows to drive casing one foot, using ? " weight falling 24 inches ±.

CARR-DEE CORP.

37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone 391-4500

To HALEY & ALDRICH, INC, CAMBRIDGE, MA. 02142 Date JUNE 26, 1987 Job No 87475

Location CHARLESTOWN NAVY YARD, CHARLESTOWN, MA. Scale 1" = 3 ft.

BORING B10

GROUND SURFACE

0'6"	CONCRETE		
	FILL	4 7 10	S#1, FROM 0'6" TO 2'6" RECOVERED 8"
	SAND,	9	
	GRAVEL,	15 32	S#2, FROM 2'6" TO 4'6" RECOVERED 12"
	BRICK,	12 8	
	CINDERS	3 3 6 9	S#3, FROM 4'6" TO 6'6" RECOVERED 11"
7'6"		10 11	S#4, FROM 6'6" TO 7'6" RECOVERED 7"
		15 18	S#4A, FROM 7'6" TO 8'6" RECOVERED 6"
	VERY STIFF	9 12 16 20	S#5, FROM 10'0" TO 12'0" RECOVERED 6"
	YELLOW CLAY,	6 8 10 13	S#6, FROM 15'0" TO 17'0" RECOVERED 8"
	TRACE GRAVEL		
		7 7 18 20	S#7, FROM 20'0" TO 22'0" RECOVERY NOT RECORDED
24'0"			

(CONTINUED ON SHEET 2)

CARR-DEE CORP.
37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone 391-4500

To HALEY & ALDRICH, INC, CAMBRIDGE, MA. 02142 Date JUNE 26, 1987 Job No 87475

Location CHARLESTOWN NAVY YARD, CHARLESTOWN, MA. Scale 1" = 3 ft.

BORING B10 (CONTINUED)

24'0"		
VERY DENSE FINE TO MEDIUM SAND AND GRAVEL, SOME CLAY	11 15 58 24	S#8, FROM 25'0" TO 27'0" RECOVERED 14"
VERY DENSE FINE TO MEDIUM SAND AND GRAVEL, SOME CLAY	18 20 29 29	S#9, FROM 30'0" TO 32'0" RECOVERED 9"
MEDIUM DENSE FINE TO MEDIUM SAND AND GRAVEL, SOME CLAY	9 12 21 21	S#10, FROM 35'0" TO 37'0" RECOVERED 4"
DENSE FINE TO MEDIUM SAND AND GRAVEL, SOME YELLOW	16 24 18 21	S#11, FROM 40'0" TO 42'0" RECOVERED 5"
CLAY	19 21 26 17	S#12, FROM 45'0" TO 47'0" RECOVERED 13"
47'6"		

(CONTINUED ON SHEET 3)

CARR-DEE CORP.
37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone 391-4500

To HALEY & ALDRICH, INC, CAMBRIDGE, MA. 02142 Date JUNE 26, 1987 Job No 87475

Location CHARLESTOWN NAVY YARD, CHARLESTOWN, MA. Scale 1" = 3 ft.

BORING B10 (CONTINUED)

47'6"

VERY DENSE

25
39
64
93

S#13, FROM 50'0" TO 52'0"
RECOVERED 12"

FINE TO MEDIUM

SAND AND GRAVEL,

11
27
35
37

S#14, FROM 55'0" TO 57'0"
RECOVERED 15"

SOME YELLOW CLAY

25
72
100
120/3"

S#15, FROM 60'0" TO 61'9"
RECOVERED 15"

61'9"

- R E F U S A L -

(120 BLOWS, S.S., 140-LB. WGT., 3" PENETRATION)

WATER LEVEL 13'0"
SIZE OF CASING NW, LENGTH 10'0"
DRILLER: K. KNOX, INSPECTOR: P. RICHARDS
DATE STARTED & COMPLETED: 6-10-87

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in right hand column indicate number of blows required to drive two-inch split sampler 6 inches using 140 lb. weight falling 30 inches ±. Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches ±.

DRAFT

REPORT ON
PHASE II
OIL AND HAZARDOUS MATERIAL SITE EVALUATION
PARCELS 39A AND 150, CHARLESTOWN NAVY YARD
CHARLESTOWN, MASSACHUSETTS

by

Haley & Aldrich, Inc.
Bedford, New Hampshire

for

Cygna Consulting Engineers
Boston, Massachusetts

File No. 6354-01

February 1988

Haley & Aldrich, Inc.

Consulting
Geotechnical Engineers,
Geologists and
Hydrogeologists

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DRAFT

__ February 1988
File No. 6354-01

Cygna Consulting Engineers
286 Congress Street
Boston, MA 02210

Attention: Mr. William H. Pineo, Vice President

Subject: Phase II Oil and Hazardous Material Site Evaluation
Parcels 39A and 150
Charlestown Navy Yard
Charlestown, Massachusetts

Gentlemen:

We are pleased to submit herewith four copies of our report entitled "Phase II Oil and Hazardous Material Site Evaluation, Parcels 39A and 150, Charlestown Navy Yard, Charlestown, Massachusetts". This work was performed in accordance with our proposal dated 19 June 1987.

Based upon the results of our Phase I and Phase II oil and hazardous material site evaluations, it is our opinion that the Massachusetts Department of Environmental Quality Engineering (DEQE) will consider the site to fall under the jurisdiction of the Massachusetts Oil and Hazardous Material Release Prevention Act, Massachusetts General Laws Chapter 21E.

Results of our Phase I and Phase II studies have revealed that the fill and upper 1 ft. to 2 ft. of underlying clay in the northeast corner of Parcel 39A have been contaminated with a mixture of gasoline and weathered No. 2 fuel oil. The volume of petroleum contaminated soil in this area of the site is estimated to be approximately 2,000 cu. yd. Subsurface explorations and chemical testing of soil samples have identified other areas of the site where localized petroleum

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contamination is present. Total chloride concentrations detected in samples of the naturally deposited clay occurring beneath the site indicate that this material would be classified as saline in character under current Massachusetts DEQE criteria.

Chemical testing of groundwater samples obtained from the on-site groundwater sampling/monitoring wells revealed the presence of benzene, total xylenes, chromium and lead at concentrations which slightly exceed established United Stated EPA Drinking Water Standards.

Since future site development will involve the excavation of fill and naturally deposited soil materials for construction of a three level underground parking garage, special handling of petroleum contaminated fill and clay should be anticipated. Saline soil material excavated during site development will also require special handling.

Haley & Aldrich, Inc. is of the opinion that the petroleum contaminated soil encountered at the site can be disposed of at an approved landfill as cover material at an approximate cost of $\$150/yd^3$. This method of disposal is contingent upon: (1) DEQE approval based upon supporting chemical data and (2) successful location of a cooperative landfill facility. Other options for petroleum contaminated soil disposal are briefly discussed in the text of this report.

Saline soil material excavated during site development may be disposed of at any coastal landfill facility as daily cover material at an approximate cost of \$8 to \$12 per yd^3.

The low levels of volatile organic compounds, chromium and lead present in the groundwater at the site preclude discharge of the groundwater to Boston Harbor or other surface water bodies during site dewatering operations without first obtaining a National Pollutant Discharge Elimination System (NPDES) discharge permit from the United States Environmental Protection Agency (EPA). The NPDES permitting process commonly involves a four to six month review process. Therefore, early completion and submittal of an NPDES permit application is advised.

Thank you for inviting us to undertake this work. We look forward to assisting you and your design team through the successful completion of this project. If you have any questions or require additional information at this time, please do not hesitate to contact us.

Sincerely yours,
HALEY & ALDRICH, INC.

Russell V. Varnum, Jr.
Senior Geologist

Richard P. Stulgis
Vice President

RVV:RPS:jms/0062-06

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I. INTRODUCTION

1-01. GENERAL

This report presents the results of additional investigations including subsurface explorations, chemical testing, and a ground penetrating radar survey conducted on Parcels 39A and 150 in the Charlestown Navy Yard, Charlestown, Massachusetts. The work performed by Haley & Aldrich, Inc., was carried out in accordance with our proposal dated 3 November 1987. A preliminary site evaluation was completed for Cygna Consulting Engineers and the results were summarized in a previous report dated 19 June 1987 entitled "Oil and Hazardous Material Site Evaluation, Parcels 39A and 150, Charlestown Navy Yard, Charlestown, Massachusetts".

This preliminary report (19 June 1987) concluded that significant levels of possible localized contamination were present at the site and that the contamination might have been associated with leakage or spillage of petroleum products from four underground storage tanks reported to have been located on Parcel 39A. Based upon historical information assembled and presented in the preliminary report, it was also concluded that other non-volatile contaminants might also be present at the site, the detection of which was below detection limits of the screening equipment employed during the preliminary site evaluation. The results of the additional explorations and chemical testing conducted during the Phase II investigations are summarized in the sections of this report which follow.

1-02. PURPOSE AND SCOPE

The purpose of this Phase II study has been to: (1) determine the nature and extent of the subsurface soil contamination encountered at the site during the Phase I study, (2) confirm the existence and location of the four underground fuel oil and gasoline storage tanks reported to have been present on the site, (3) determine whether the groundwater beneath the site has been adversely impacted by past site usages, (4) determine whether special handling of soil and/or groundwater would be required during proposed future site development, and (5) formulate an opinion as to the applicability of the Massachusetts Oil and Hazardous Material Release Prevention Act (Chapter 21E of the Massachusetts General Laws) to the subject site.

1-03. LIMITATIONS

This letter has been prepared for the use of Cygna Consulting Engineers in connection with an application for financing associated with Parcels 39A and 150 of the Charlestown Navy Yard in Charlestown, Massachusetts.

The conclusions provided by Haley & Aldrich, Inc. are based solely on the scope of work conducted and the sources of information referenced in this report. Any additional information that becomes available concerning this site should be provided to Haley & Aldrich, Inc., so that our conclusions may be reviewed and modified as necessary.

The work performed by Haley & Aldrich, Inc. is subject to the terms and conditions stated in our proposals dated 22 April 1987 and 3 November 1987. This work has been undertaken in accordance with generally accepted consulting engineering practices. No other warranty, express or implied, is made.

It is our understanding that this report is to be used and distributed exclusively for purposes connected with the pending application for financing and to determine the potential impact on pending site development.

II. FIELD AND LABORATORY INVESTIGATIONS

2-01. GENERAL

A program of limited subsurface explorations, laboratory screening of soil samples, chemical testing of soil and groundwater samples, and a ground penetrating radar survey were completed at the site for this investigation. Subsurface data from previously completed subsurface explorations were also reviewed during the course of this investigation.

2-02. GROUND PENETRATING RADAR SURVEY

On 29 December 1987, a total of 27 ground penetrating radar (GPR) survey lines (lines A-A' through T-T' and lines 1-1' through 7-7') were completed on Parcel 39A by a Haley & Aldrich, Inc. environmental geologist. The locations of the GPR survey lines and detected anomalies are shown on Figure 2.

2-03. SUBSURFACE EXPLORATIONS

Ten, 2.5 in. diameter standard test borings (labeled B1 through B10) were completed on the site for geotechnical design purposes.

Test borings B1 through B6 were completed on the site by John J. Boyle of Wilton, Massachusetts during the periods 29 April to 27 May and 1 to 3 June 1987. Test borings B7 through B10 were completed by Carr-Dee Corporation of Medford, Massachusetts during the period 9 to 10 June 1987. The locations of the previously completed test borings are shown on Figure 2. Boring logs completed by the drilling contractors are provided in Appendix A.

In general, test borings (B1 through B10) were conducted to better define the limits and nature of the fill and naturally deposited overburden soils. The borings ranged from 52.0 to 62.0 ft. in depth below existing ground surface. Groundwater observation wells consisting of machine-slotted PVC screen were installed in completed borings B2(OW), B4(OW) and B6(OW). Each well was protected at the ground surface by a roadway box. Groundwater observation well installation and groundwater monitoring reports are provided in Appendix B. Monitoring of test borings and groundwater observation well installations was provided by a Haley & Aldrich, Inc. geologist.

2.04 SUBSURFACE EXPLORATIONS COMPLETED DURING THIS STUDY

During the Phase II environmental investigation three additional test borings (labelled B100 through B102) were completed at the site by Kennedy Drilling of Fitzwilliam, New Hampshire on 30 December 1987. The location of these borings are shown on Figure 2. These borings ranged from 14.9 ft. to 15.0 ft. in depth below ground surface and were completed using 6.5 in. (outside diameter) hollow stem augers. A groundwater observation well was installed in each of the completed Phase II borings. The groundwater observation wells were similar in construction to those installed during the geotechnical design investigations. The test borings and groundwater observation well installations were monitored by a Haley & Aldrich, Inc. environmental geologist. Boring logs completed by a Haley & Aldrich, Inc. environmental geologist are provided in Appendix A. Groundwater observation well installation and groundwater monitoring reports are provided in Appendix B.

Additionally, eight machine-excavated test pits (labeled TP1 through TP8) and one machine-excavated trench (OT1) were completed on Parcel 39A by J. Marchese & Sons on 31 December 1987. The test pits ranged from 1.5 ft. to 12.0 ft. in depth below ground surface. The observation trench extended to a maximum depth of 4.5 ft. below ground surface. Locations of the test pits and trench are shown on Figure 2. Logs of the test pits and trench were completed by a Haley & Aldrich, Inc. environmental geologist and are provided in Appendix C.

The Phase II test borings, groundwater observation wells, test pits, and observation trench were completed to obtain soil and groundwater samples for chemical testing to determine whether special handling of soil and/or groundwater would be required during proposed future site development. The general subsurface geologic conditions existing on the site were presented in our 23 October 1987 geotechnical report entitled "Report on Soil and Foundation Investigation, Proposed Site Development, Parcels 39A and 150, Boston Naval Shipyard, Charlestown, Massachusetts" and our 19 June 1987 letter report entitled "Oil and Hazardous Material Site Evaluation, Parcels 39A and 150, Charlestown Navy Yard, Charlestown, Massachusetts". The subsurface environmental conditions existing on-site are contained herewith.

2-05. LABORATORY SCREENING

The soil samples obtained from the recently completed test borings and test pits, as well as the soil samples obtained from the previously completed test borings (labeled B1 through B10)

were placed in screw-top glass jars, covered with aluminum foil, sealed tightly with a metal lid, placed in a cooler with ice and transported to the Haley & Aldrich, Inc. laboratory.

In the laboratory, the soil samples were test-screened for the presence of volatile organic compounds using an HNU Systems PI101 Photoionization Analyzer, by exposing the instrument sensor to headspace gases in sample jars at room temperature.

The instrument is sensitive to the presence of ionizable vapors of biogenic and organic compounds, but does not distinguish between specific compounds. Rather, the instrument's response to an unknown (sample) is compared to the concentration of benzene (in parts-per-million, ppm) that would produce the same response under controlled conditions of calibration in the laboratory. As such, the readings are useful only for qualitative purposes (identifying the presence of volatile organics in general), and in some instances for semi-quantitative purposes (assigning relative concentrations among samples where the same organic compounds are present in each).

The results of the HNU screening are presented in Table I and discussed in Section 3-05 of this report.

2-06. CHEMICAL TESTING PROGRAM

Soil samples B100-S2, TP1-S1, TP2-S1 and TP3-S1 were submitted to Enseco, a Massachusetts DEQE recognized analytical laboratory, on 31 December 1987 to undergo analyses for the presence of pesticides, PCBs and EP toxicity metals. Soil sample TP1-S1 was also submitted along with soil samples B100-S5 and B102-S5 to undergo total petroleum hydrocarbon analyses (infrared method). Soil sample TP3-S2 was submitted for petroleum finger printing analysis and soil samples TP2-S2, B101-S3 and TP5-S2 were submitted for total chlorides and pH analyses. The results of the chemical testing of soils are included as Appendix D, summarized in Table II and discussed in Section 3-05 of this report. Laboratory quality assurance/ quality control documentation is included as Appendix E.

Groundwater samples were obtained from groundwater observation wells B2(OW), B4(OW), B100(OW), B101(OW) and B102(OW) on 4 January 1988. Three well volumes of standing water in each well were removed with a stainless steel bailer prior to obtaining the groundwater samples. Prior to bailing each well, the bailer was washed with a soap and tap water mixture and successively rinsed with tap water, distilled water, methanol and distilled water.

Groundwater samples B4(OW), B100(OW) and B102(OW) were submitted to Enseco on 4 January 1988 to be tested for the presence of EPA hazardous substance list volatile organic compounds (EPA method 624), EPA listed priority pollutant metals, EPA hazardous substance list semi-volatile organic compounds (EPA method 625), EPA listed priority pollutant organochlorine pesticides and PCBs, cyanide and total petroleum hydrocarbons (EPA method 418.1).

Groundwater sample B2(OW) was submitted for analysis for the presence of EPA hazardous substance list volatile organic compounds (EPA method 624), total petroleum hydrocarbons (EPA method 418.1) and cyanide. Groundwater sample B101(OW) was submitted to be analyzed for the presence of EPA listed priority pollutant metals. The results of the chemical testing are included in Appendix D, summarized in Table III and discussed in Section 3-06 of this report.

III. SITE CONDITIONS

3-01. GENERAL

The approximately 40,000 sq. ft. site (labeled Parcel 39A and Parcel 150) is owned by The Boston Redevelopment Authority and is located within the Naval Shipyard, Charlestown, Massachusetts, as shown on Figure 1, Project Locus.

Parcel 39A is bound to the east and west by First and Second Avenues, respectively. The parcel is bound to the north by Sixth Street and to the south by Building 39.

Parcel 150 is located northwest of Parcel 39A. It is bound to the east by Second Avenue and to the north and west by Ninth Street and Third Avenue. Parcel 150 is bound to the south by Building 38.

3-02. SITE HISTORY

Historical records indicate that Parcel 39A was occupied by a variety of structures since the 1800's until all structures were demolished in 1978 (1,2,3,4,5,6)*. These buildings were used by the Department of the Navy for various purposes including a sail loft, offices, a prison, a storehouse and armory (2). According to site plans prepared by the Navy, four 7,500 gallon capacity gasoline storage tanks and two gasoline pumps were located in the northwest corner of the site during the early 1940's (2,7).

No building structures remain on-site today, except for the buried remains of building foundations that exist below a blanket of surface fill material. Research at the Boston Fire Department indicated that no records exist of a license being issued for the installation or removal of the underground storage tanks at the site; however, according to the Boston Fire Department, the Navy was not required to obtain a license for the installation/removal of underground storage tanks (8).

Historical records indicate that Parcel 150 has existed as a parking lot since 1978 (1), and prior to 1978 the parcel was occupied by a variety of structures (2,3,4,5). Some of the buildings were constructed in the early 1820's (3,4), with most of the buildings remaining on-site until all structures were demolished in 1978 (1). These buildings consisted of both wood

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* Refer to Sources of Information included with this report.

and masonry frame structures and included sheds, a garage for trucks, auxiliary service substation and a cart shed (2,3,4,5,7). No building structures remain on-site today.

3-03. SURFICIAL ENVIRONMENTAL CONDITIONS

The site consists of two parcels of land (Parcel 39A and Parcel 150) located adjacent to each other but separated by Second Avenue. The two parcels have a combined area of approximately 40,000 sq. ft. Parcel 39A and Parcel 150 are located immediately south and north of Second Avenue, respectively.

Each parcel has been filled and graded. The ground surface is gravel/sand and partially grass covered over Parcel 39A and paved with asphalt over Parcel 150. Access to Parcel 150 is from the west via Third Avenue. Access to Parcel 39A is limited due to a 4 to 5 ft. high snow fence constructed along the perimeter of the parcel.

The ground surface is relatively level over the entire site.

3-04. SUBSURFACE ENVIRONMENTAL CONDITIONS

A series of aligned ground penetrating radar anomalies encountered on the western portion of Parcel 39A are shown on Figure 2. The anomalies coincide with reported locations of two buried foundation walls. The existence of the foundation walls was confirmed by machine-excavated test pits.

A large number of anomalies were encountered at the reported locations of four buried underground storage tanks, as shown on Figure 2. In general, the results of the GPR survey indicated that a number of discontinuous, non-cylindrical, objects (possibly demolition debris) were present at shallow depths below the ground surface within the area of the site that reportedly had contained underground storage tanks.

The ground surface at the site had been graded prior to completion of the GPR survey. However, due to previous rainstorms and poor site drainage; site grading resulted in the production of numerous ruts ranging from 0.5 ft. to 1.5 ft. in depth. The irregular site topography caused significant interference with reflected GPR signals producing data which was extremely difficult to interpret. Therefore, an observation trench was excavated across the area of the site where the four underground storage tanks had reportedly been present in 1914. The purpose of the observation trench was to observe the sources of the identified GPR anomalies and to confirm the presence or absence of the underground storage tanks.

Fill generally consisting of gravelly silt with frequent brick fragments, concrete, wood, cinders and occasional granite blocks was encountered to depths of between 1.5 ft. and 6.7 ft. in test pits TP1 through TP8, and observation trench OT1.

Granite block foundation walls were encountered from a depth of 2.0 ft. to 6.7 ft. below ground surface at the east and west ends of test pit TP1. A wooden floor extending between the foundation walls was encountered at a depth of 6.7 ft. Granite block foundation walls were encountered at depths of 4.0 ft. and 5.5 ft. in test pits TP7 and TP8, respectively. A wooden floor was also encountered at a depth of 4.0 ft. in test pit TP5. A "brine like" odor was detected beneath the wooden floor in test pit TP5.

A large concrete slab measuring 15 ft. in length and more than 5 ft. in width was encountered at a depth of 1.6 ft. in test pit TP4. Test pit TP6 was terminated at refusal on large concrete slab fragments at a depth of 1.5 ft.

Observation trench OT1 was terminated at an approximate depth of 4.5 ft. when numerous large fuel oil stained concrete slab fragments were encountered at the reported locations of the former underground storage tanks. Petroleum stains and the geometry of the concrete slab fragments indicate that they are probably the demolished remains of previously existing concrete underground fuel oil storage tanks.

Moderate fuel oil odors were detected in naturally deposited clayey silt samples from a depth of 7 to 9 ft. in boring B100. Field screening of soil brought to the ground surface by the auger flights, yielded elevated HNU PI101 readings of 5 parts per million (ppm). Normal background HNU PI101 readings generally ranged between 0.0 ppm to 2.0 ppm. A more detailed description of the analyzer is provided in the "Laboratory Screening" section of this letter.

Moderate to strong fuel oil odors were detected in fill and naturally deposited soil from boring B102 obtained from depths of approximately 5 to 12 ft. below ground surface. Field screening of soil brought to the ground surface by auger flights yielded significantly elevated HNU-PI101 readings ranging from 40 to 50 ppm.

Strong fuel oil odors as well as visible droplets of fuel oil were encountered in naturally deposited soil at a depth of 5 to 8 ft. in test pit TP3. Numerous railroad ties were encountered in the upper 2 ft. of test pit TP3. HNU-PI101 screening of the ambient atmosphere near test pit TP3 yielded highly elevated readings of 30 to 500 ppm. Moderate fuel oil odors were also encountered in observation trench OT1.

Elevated HNU-PI101 readings of between 4 to 21 ppm were previously obtained in the field from soil samples from depths of 4 ft. to 6 ft. in borings B1 and B2, and 10 to 11 ft. in boring B5.

3-05. CHEMICAL CHARACTERISTICS OF FILL AND SOIL MATERIAL

A. HNU Screening

Non-elevated to slightly elevated HNU PI101 readings of 0.0 to 3.8 ppm above ambient background were obtained from soil samples from all of the borings and many of the test pits. Elevated HNU PI101 readings of 5.2 to 11.2 ppm above background were obtained from samples B1-S1, B2-S2, B5-S6, B7-S4, and TP3-S1.

Significantly elevated HNU PI101 readings of between 23.6 and 99.6 ppm above background were obtained from samples B8-S1 and S5, B100-S2, B102-S3 through S5, TP3-S1a and TP6-S1. Highly elevated HNU PI101 readings of between 139.6 and 167.6 ppm above background were obtained from samples B8-S2 through S4.

B. Soil Testing

Total petroleum hydrocarbon analyses indicated the presence of petroleum hydrocarbons in samples B100-S2 (26.0 ppm), B102-S5 (100.0 ppm), TP1-S1 (250.0 ppm), and TP3-S2 (350.0 ppm). The current DEQE working criteria used to determine whether contaminated soil requires removal is 100.0 ppm. However, this criteria is flexible and the DES may permit soils containing higher concentrations of petroleum hydrocarbons to remain in-place on a site. Each determination is made on a site-by-site basis.

EP Toxicity Metals, pesticides and PCBs were not detected in the samples tested for these contaminants.

Total chloride analyses indicated the presence of 682 ppm, 2,220 ppm and less than 62 ppm total chlorides in samples B101-S2, TP2-S2 and TP5-S2, respectively. A current DEQE policy states that excavated soils which are not re-used on-site and contain more than 250 ppm total chlorides must be disposed of in coastal solid waste landfills as daily cover material.

Analyses of the pH of soil samples B101-S3, TP2-S2 and TP5-S2 indicate that the pH of the soil at the site ranges from 6.4 to 7.6.

3-06. GROUNDWATER CONDITIONS

Recent groundwater level readings obtained from the groundwater observation wells indicate that the groundwater level ranges from approximately El. 108 (Boston Navy Yard Basic Bench) to approximately El. 113. It is expected that groundwater levels within the site are influenced by both man-made and natural features. The proximity of Boston Harbor may also have an effect on the groundwater regime in the general area. It should also be expected that groundwater levels will fluctuate due to season, precipitation, temperature, and other environmental effects. Groundwater monitoring reports are included in Appendix C.

The groundwater table beneath the site is generally flat and groundwater flow is anticipated to be toward the southeast.

Samples of the upper 0.8 ft. of the groundwater in observation wells B2(OW), B4(OW), B100(OW), B101(OW) and B102(OW) were obtained on 4 January 1988. The groundwater samples from wells B100(OW), B101(OW) and B102(OW) were colorless, slightly cloudy and free of visible petroleum products. A slight petroleum odor was detected in the samples from B100(OW) and B102(OW). The samples from wells B2(OW) and B4(OW) were brown, very cloudy to opaque and free of visible petroleum products and odors.

Chemical analyses revealed the presence of trace concentrations of phenol in the groundwater sample from well B102(OW) and trace concentrations of N-Nitrosodiphenylamine in the groundwater samples from wells B100(OW) and B102(OW). Napthalene and 2-Methylnapthalene were detected in sample B102(OW) at concentrations of 110 parts per billion (ppb) and 21 ppb, respectively. Priority pollutant organochlorine pesticides and PCBs were not detected in the groundwater samples tested for those contaminants (B4(OW), B100(OW) and B102(OW)).

The following volatile organic compounds (VOCs) were detected in the groundwater sample from well B102(OW): benzene (170 ppb), ethyl benzene (280 ppb) and total xylenes (470 ppb). Volatile organic compounds were not detected in any of the other groundwater samples tested for VOCs.

The following dissolved metals were detected at the indicated concentrations in the groundwater sample from well B4(OW): arsenic (0.17 ppm), beryllium (0.0035 ppm), chromium (0.20 ppm), copper (0.33 ppm), lead (0.17 ppm), mercury (0.00035 ppm), nickel (0.13 ppm) and zinc (0.47 ppm). Arsenic was also detected in sample B102(OW) at a concentration of 0.0077 ppm. Zinc was also detected in samples B100(OW) and B102(OW) at

concentrations of 0.015 ppm and 0.010 ppm, respectively. Selenium was detected at concentrations of 0.0089 ppm and 0.0058 ppm in samples B100(OW) and B101(OW), respectively.

Cyanide was detected at a concentration of 0.015 ppm in sample B2(OW). Cyanide was not detected at concentrations above the minimum detection limit of 0.010 ppm in samples B4(OW), B100(OW) and B102(OW). Sample B101(OW) was not tested for cyanide.

Petroleum hydrocarbons were detected at total concentrations of 1.3 ppm, 0.7 ppm and 1.6 ppm in samples B2(OW), B4(OW) and B102(OW). Petroleum hydrocarbons were not detected in sample B100(OW). Sample B101(OW) was not tested for petroleum hydrocarbons.

Of the contaminants detected, only the concentrations of benzene (170 ppb) and total xylenes (470 ppb) in sample B102(OW) and chromium (0.20 ppm) and lead (0.17 ppm) in sample B4(OW) exceed established United States Drinking Water Standards and proposed U. S. Environmental Protection Agency Drinking Water Recommended Maximum Contaminant Levels (RMCLs). U. S. Drinking Water Standards and EPA Drinking Water RMCLs have not been established for Napthalene, 2-Methylnapthalene, N-Nitrosodiphenylamine, beryllium, nickel, total cyanide or total petroleum hydrocarbons. Applicable regulatory standards for the detected contaminants are presented in Table III.

IV. CONCLUSIONS

An oil and hazardous material site evaluation has been performed comprising a review of readily-available information on site history, development and usage. Several phases of subsurface explorations, laboratory screening of soil samples, and chemical testing of soil and groundwater samples have been conducted for this investigation. In addition a GPR survey and recent excavations in areas where anomalies were detected by the GPR survey have been completed.

The recent subsurface explorations and laboratory screening and chemical testing of soil samples have revealed that the fill and upper 1 ft. to 2 ft. of underlying clay in the northeast corner of Parcel 39A have been contaminated with a mixture of gasoline and weathered No. 2 fuel oil associated with four demolished underground fuel oil and gasoline storage tanks. Total petroleum hydrocarbon analyses indicate the petroleum mixture present in the soil in this area of the site occurs at concentrations ranging from 100 to 350 ppm.

Based upon limited subsurface explorations and laboratory screening and chemical testing of soil samples, the petroleum contamination in the "tank area" appears to be limited to an area which is approximately 100 ft. in length by 40 ft. in width and extends to an estimated depth of 15 ft. The volume of petroleum contaminated soil is estimated to be approximately 1950 yd^3.

Subsurface explorations and chemical testing of soil samples have also identified other areas of the site where localized petroleum contamination is present. A significantly elevated HNU reading of 7.2 ppm above ambient background was obtained from a fill sample from a depth of 4 to 6 ft. below ground surface in boring B1. Urban fill materials typically yield HNU readings of between approximately 1 and 10 ppm. The elevated HNU reading from boring B1 may be due to localized petroleum contamination associated with the demolition of the previously existing building formerly located on Parcel 39A.

A significantly elevated HNU reading of 11.2 ppm above ambient background was obtained from a natural clay sample obtained from a depth of 10 to 11 ft. below ground surface in boring B5. The presence of volatile organic compounds in natural clay near the surface of the groundwater table indicates that the elevated HNU reading may be due to water born contamination associated with localized petroleum contamination of overlying fill, most likely associated with the demolition of the previously existing building.

Chemical test results indicate the presence of 250 ppm total petroleum hydrocarbons in a fill sample from test pit TP1, located within the foundation walls of a formerly existing building. Due to the fact that the petroleum contaminated fill material is contained within the foundation walls of the formerly existing building, the petroleum contamination detected is most likely localized and associated with the demolition of the building.

A highly elevated HNU reading of 43.6 ppm above ambient background was obtained from a fill sample with a moderate petroleum odor from a depth of 3 to 5 ft. in boring B100. HNU data obtained from underlying fill samples indicate that the petroleum contamination in the overlying fill is most likely localized and not indicative of large scale contamination.

Total chloride analyses completed on clay samples obtained from depths below the surface of the water table indicate total chloride concentrations of between 682 and 2,220 ppm. The total chloride concentrations detected in the clay samples indicate that the clay is saline in character and would require special handling if removed from the site.

Chemical testing of groundwater from five groundwater observation wells located on the site revealed the presence of benzene, total xylenes, chromium and lead at concentrations which slightly exceed established United States EPA Drinking Water Standards. Volatile organic compounds (benzene, ethylbenzene and total xylenes) were only detected in groundwater sample B102-OW at a total concentration of 920 ppb (0.92 ppm).

Based upon the information presented in this letter report and our 19 June 1987 letter report entitled "Report on Oil and Hazardous Materials Site Evaluation, Parcels 39A and 150, Charlestown Navy Yard, Charlestown, Massachusetts", we conclude that:

1. The Massachusetts DEQE would consider the site to fall under the jurisdiction of the Massachusetts Oil and Hazardous Material Release Prevention Act, Chapter 21E of the Massachusetts General Laws.

2. Petroleum contaminated soil appears at the location of the previously existing underground storage tanks and at the location of borings B1, B5 and B100, and test pit TP1.

3. Soil contamination by toxic metals, pesticides or PCBs does not appear to be an issue at this site.

4. Since future site development involves the excavation of fill and naturally deposited soil materials to construct three levels of underground parking, special handling of the petroleum contaminated fill and clay occurring in the area of previously existing underground tanks and other local areas would be required.

   According to the recently released Massachusetts DEQE "Interim Policy for the Management of Residuals Under M.G.L. Chapter 21E from Spills/Releases of Virgin Petroleum Oils", dated 22 December 1987, soil contaminated with gasoline exhibiting headspace concentrations of volatiles less than 1800 ppm (measured with a photoionization detector) and soils contaminated with oil residuals exhibiting total petroleum hydrocarbon concentrations less than 3000 ppm may be disposed of in landfills for use as daily cover material provided that: (a) the generator can show through analytical data that the petroleum contaminant within the excavated soil is a virgin petroleum product, (b) prior DEQE approval has been obtained, and (c) a suitable and cooperative landfill has been located. Lined landfills and landfills with environmental monitoring are preferentially considered. Unlined landfills may accept these soils only if in the opinion of the DEQE no other alternative is reasonably available.

   Haley & Aldrich, Inc. is of the opinion that the petroleum contaminated soil encountered at the site can be disposed of at an approved landfill for cover material at an approximate cost of $150/yd^3.

   However, if a cooperative landfill cannot be located, other options for the disposal of petroleum contaminated soil include disposal at the Consolidated Waste Services facility in Noridgewock, Maine at an approximate cost of $300/yd^3, or disposal at a secure hazardous waste landfill in Model City, New York at an approximate cost of $400/yd^3. Regardless of which disposal option is employed, the receiving facility will require additional chemical testing to confirm/document the chemical characteristics of the soil.

5. The oil stained concrete tank fragments may be cleaned, stripped of free petroleum product and disposed of in a solid waste landfill at an estimated cost of $65 - $75 per ton.

6. The non-contaminated surface fill material can be disposed of as "clean fill". Accepting facilities may require chemical testing to document the chemical nature of the fill prior to disposal.

7. Saline soil materials located below the water table which are excavated for the construction of the parking garage and associated office building will require special handling which simply involves transporting the saline materials to a coastal landfill to be used as daily cover material at an approximate cost of $8 to $12 per yd^3.

8. The low levels of volatile organic compounds, chromium and lead present in the groundwater at the site preclude discharge of the groundwater to Boston Harbor or other surface water bodies during dewatering operations without first obtaining a National Pollutant Discharge Elimination System (NPPES) discharge permit from the United States EPA.

   The NPDES permitting process commonly involves a four to six month review process. An alternative method of dewatering the site would involve obtaining a temporary discharge permit from the Massachusetts Water Resources Authority (NWRA). However, the MWRA has recently adopted a policy which prohibits discharge of groundwater, surface water, or roof drain water to the MWRA System unless no other method of disposal is available.

V. RECOMMENDATIONS

In our opinion the proposed site development and required remedial action can be completed at the site simultaneously. To minimize project delays and address the environmental concerns associated with the proposed site development, we recommend the following:

1. Two copies of our June 1987 and February 1988 "Oil and Hazardous Material Site Evaluations" be provided to the Massachusetts DEQE Division of Hazardous Waste with a cover letter briefly summarizing the results of our studies, intended soil disposal plans, and requesting a list of approved landfills known to accept petroleum contaminated and saline soils.

2. A letter be sent to the MWRA briefly summarizing the site conditions, results of the groundwater testing, and proposed site development along with an application for a permit to discharge groundwater via the MWRA sewer system. Additional groundwater testing may be required prior to obtaining an MWRA discharge permit.

3. A letter be sent to the Boston, Massachusetts office of the U.S. Environmental Protection Agency summarizing site conditions, results of the groundwater testing, and proposed site development along with a completed application for an NPDES discharge permit. Additional groundwater testing may be required prior to obtaining approval for a discharge permit.

4. Excavation of petroleum contaminated soil and concrete in the "tank area" by an experienced remedial action contractor and transportation of said soil and concrete to a DEQE approved landfill(s) for disposal prior to initiating full scale site development activities. Chemical testing of stockpiled soil will most likely be required prior to disposal. Visibly contaminated petroleum groundwater encountered during the excavation and removal of the demolished underground storage tanks and contaminated soil should be pumped into a tank truck and disposed of in accordance with current local, state and federal environmental regulations.

5. Petroleum contaminated soil which may be encountered locally on the site during site development should be separated from other "clean soil", stockpiled for chemical testing and

laboratory screening, and disposed of according to current state and federal environmental regulations. Stockpiled contaminated soil should be placed on and covered by sheets of polyethylene until disposal is accomplished.

SOURCES OF INFORMATION

1. Haley & Aldrich, Inc. telephone communication with Mr. James English, Boston Redevelopment Authority, Boston, Massachusetts on 2 June 1987.

2. Plans of U.S. Navy Yard, Boston, Massachusetts, showing the locations of the improvements recommended in the Annual Report to the Bureau of Yards and Docks, USN (1866-1973), to a scale of 1" = 100'.

3. Drawing entitled, "A Plan of Boston in New England with its Environs with the Military Works," no scale, dated 1777.

4. Norton, Bettina, "The Boston Naval Shipyard, 1800 to 1974", in The Bostonian Society, 1975.

5. Bears, Edwin C., "Charlestown Navy Yard, 1800 to 1842", Boston National Historical Park, Massachusetts, 1984.

6. Map of Boston and Its Vicinity, prepared by John G. Hales, scale 1 inch = 1 mile, 1833.

7. "Topographic and Subsurface Map, U.S. Navy Yard, Boston Mass.," U.S. Navy Yard, Boston, Mass.", USN, 1913, 1914, to a scale of 1" = 10'.

8. Central Transportation Planning Staff of Massachusetts DPW, "Charlestown City Square: A Topographical History", 1980.

9. Haley & Aldrich, Inc. review of records at the Boston Fire Department on 7 May 1987.

10. Haley & Aldrich, Inc. file review at Department of Environmental Quality Engineering (DEQE), Northeast Regional Office on 7 May 1987.

11. Haley & Aldrich, Inc. telephone communication with John Shays, Boston Division of Health and Hospitals on 11 May 1987.

12. Haley & Aldrich, Inc. telephone communication with John Shays, Boston Division of Health and Hospitals on 11 May 1987.

13. Department of Environmental Quality Engineering, Division of Hazardous Waste, "List of Confirmed Disposal Sites and Locations to be Investigated," 15 April 1987.

OIL AND HAZARDOUS MATERIAL SITE EVALUATION
PARCELS 39A AND 150
CHARLESTOWN NAVY YARD
CHARLESTOWN, MASSACHUSETTS

TABLE I
(Page 1 of 5)

HNU READING OF HEADSPACE IN SAMPLE JARS
FOR DETECTABLE VOLATILE ORGANIC COMPOUNDS

BORING NUMBER	SAMPLE NUMBER	DEPTH (feet)	SAMPLE TYPE	HNU* SAMPLE (ppm)**	HNU* BACKGROUND (ppm)**
B1	S1	0.0-2.0	FILL	0.8	0.8
	S2	2.0-4.0	FILL	2.6	0.8
	S3	4.0-6.0	FILL	8.2	1.0
B2	S1	0.0-2.0	FILL	0.8	0.8
	S2	2.0-4.0	FILL	12.0	0.8
	S3	4.0-6.0	FILL	3.6	0.8
	S4	6.0-8.0	SAND	1.6	0.8
B3	S1	0.0-2.0	FILL	0.6	0.6
	S2	2.0-4.0	FILL	0.6	0.6
B4	S1	0.5-2.5	FILL	1.2	0.8
	S2	2.5-3.5	FILL	3.6	0.8
	S3	5.0-7.0	FILL	1.2	0.8
	S4	7.0-9.0	FILL	0.8	0.8
	S5	9.0-11.0	FILL	3.2	0.8
	S6	11.0-13.0	FILL	1.2	0.8
B5	S1	0.0-2.0	FILL	1.0	0.8
	S2	2.0-4.0	FILL	0.6	0.6
	S3	4.0-6.0	FILL	1.2	0.8
	S4	6.0-8.0	FILL	1.6	0.8
	S5	8.0-9.0	FILL	4.2	0.8
	S5a	9.0-10.0	CLAY	1.6	0.8
	S6	10.0-11.0	CLAY	12.0	0.8
B6	S1	1.0-3.0	FILL	1.0	0.6
	S2	3.0-5.0	FILL	1.0	0.6
	S3	5.0-7.0	FILL	1.0	0.6

* INSTRUMENT WAS CALIBRATED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDED PROCEDURE USING A CALIBRATION GAS SUPPLIED BY THE MANUFACTURER.

** ppm REPRESENTS CONCENTRATION OF DETECTABLE VOLATILE AND GASEOUS COMPOUNDS IN PARTS PER MILLION OF AIR.

OIL AND HAZARDOUS MATERIAL SITE EVALUATION
PARCELS 39A AND 150
CHARLESTOWN NAVY YARD
CHARLESTOWN, MASSACHUSETTS

TABLE I
(Page 2 of 5)

HNU READING OF HEADSPACE IN SAMPLE JARS
FOR DETECTABLE VOLATILE ORGANIC COMPOUNDS

BORING NUMBER	SAMPLE NUMBER	DEPTH (feet)	SAMPLE TYPE	HNU* SAMPLE (ppm)**	HNU* BACKGROUND (ppm)**
B7	S1	0.0-2.0	FILL	0.2	0.2
	S2	2.0-4.0	FILL	0.2	0.2
	S3	5.0-7.0	FILL	1.2	0.2
	S4	7.0-9.0	FILL	9.8	0.2
	S5	10.0-12.0	CLAY	1.4	0.8
	S6	15.0-17.0	SILT	1.0	0.8
	S7	20.0-22.0	SILT	0.8	0.8
	S8	25.0-27.0	SILT	0.8	0.8
	S10	35.0-37.0	TILL	0.8	0.8
	S11	40.0-42.0	TILL	0.6	0.6
	S12	45.0-47.0	TILL	0.8	0.6
	S13	50.0-52.0	TILL	1.0	0.6
	S14	55.0-57.0	TILL	0.8	0.8
	S15	60.0-62.0	TILL	1.0	0.6
B8	S1	0.0-2.0	FILL	38.0	0.4
	S2	2.0-4.0	FILL	140.0	0.4
	S3	4.0-6.0	FILL	168.0	0.4
	S4	6.0-8.0	FILL	150.0	0.4
	S5	8.0-10.0	FILL	62.0	0.4
	S6	10.0-12.0	CLAY	1.6	0.6
	S7	15.0-17.0	TILL	1.0	0.6
	S8	20.0-22.0	TILL	1.0	0.6
	S9	25.0-27.0	TILL	1.0	0.6
	S10	30.0-32.0	TILL	1.0	0.6
	S11	35.0-37.0	TILL	0.8	0.8
	S12	40.0-42.0	TILL	0.8	0.8
	S13	45.0-47.0	TILL	0.8	0.8
	S14	50.0-52.0	TILL	0.8	0.8
	S15	55.0-57.0	TILL	0.8	0.8
B9	S1	0.5-2.5	FILL	0.8	0.8
	S2	2.5-4.5	FILL	0.6	0.8
	S3	4.5-5.5	FILL	0.8	0.8
	S3a	5.5-6.5	CLAY	1.0	0.8
	S4	6.5-8.5	CLAY	1.4	0.8
	S5	8.5-10.5	CLAY	1.0	0.8

OIL AND HAZARDOUS MATERIAL SITE EVALUATION
PARCELS 39A AND 150
CHARLESTOWN NAVY YARD
CHARLESTOWN, MASSACHUSETTS

TABLE I
(Page 3 of 5)

HNU READING OF HEADSPACE IN SAMPLE JARS
FOR DETECTABLE VOLATILE ORGANIC COMPOUNDS

BORING NUMBER	SAMPLE NUMBER	DEPTH (feet)	SAMPLE TYPE	HNU* SAMPLE (ppm)**	HNU* BACKGROUND (ppm)**
	S6	15.0-17.0	TILL	1.0	0.8
	S7	20.0-22.0	TILL	0.8	0.8
	S8	25.0-27.0	TILL	1.2	0.8
	S9	30.0-32.0	TILL	1.2	1.0
	S10	35.0-37.0	TILL	1.2	0.8
	S11	40.0-42.0	TILL	1.2	0.8
	S12	45.0-47.0	TILL	1.2	0.8
	S13	50.0-50.2	TILL	1.0	0.8
	S14	55.0-57.0	TILL	1.0	0.8
	S15	60.0-62.0	TILL	1.0	0.8
B10	S1	0.5-2.5	FILL	0.6	0.8
	S2	2.5-4.5	FILL	0.6	0.8
	S3	4.5-6.5	FILL	0.4	0.8
	S4	6.5-7.5	FILL	9.4	0.8
	S4a	7.5-8.5	FILL	1.4	0.8
	S5	10.0-12.0	CLAY	1.2	0.8
	S6	15.0-17.0	CLAY	1.2	0.8
	S7	20.0-22.0	CLAY	1.2	0.8
	S8	25.0-27.0	TILL	1.0	0.9
	S9	30.0-32.0	TILL	1.0	0.8
	S10	35.0-37.0	TILL	1.0	0.8
	S11	40.0-42.0	TILL	1.2	0.8
	S12	45.0-47.0	TILL	1.2	0.8
	S13	50.0-52.0	TILL	0.8	0.8
	S14	55.0-57.0	TILL	0.8	0.8
	S15	60.0-61.9	TILL	0.8	0.8
B100	S1	0.6-2.0	FILL	0.8	0.4
	S2	3.0-5.0	FILL	44.0	0.4
	S3	5.0-7.0	FILL	1.0	0.4
	S4	7.0-9.0	CLAY	1.2	0.4
	S5	10.0-12.0	CLAY	1.6	0.4

OIL AND HAZARDOUS MATERIAL SITE EVALUATION
PARCELS 39A AND 150
CHARLESTOWN NAVY YARD
CHARLESTOWN, MASSACHUSETTS

TABLE I
(Page 4 of 5)

HNU READING OF HEADSPACE IN SAMPLE JARS
FOR DETECTABLE VOLATILE ORGANIC COMPOUNDS

BORING NUMBER	SAMPLE NUMBER	DEPTH (feet)	SAMPLE TYPE	HNU* SAMPLE (ppm)**	HNU* BACKGROUND (ppm)**
B101	S1	0.0-2.0	FILL	1.6	0.4
	S2	5.0-7.0	TILL	0.8	0.4
	S3	10.0-12.0	TILL	0.8	0.4
	S4	13.0-15.0	TILL	0.8	0.4
B102	S1	0.5-2.0	FILL	2.1	0.4
	S2	2.0-5.0	FILL	6.4	0.4
	S3	5.0-7.0	FILL	56.0	0.4
	S4	7.0-9.0	FILL	70.0	0.4
	S5	10.0-12.0	TILL	82.0	0.4
	S6	13.0-15.0	TILL	4.2	0.4

OIL AND HAZARDOUS MATERIAL SITE EVALUATION
PARCELS 39A AND 150
CHARLESTOWN NAVY YARD
CHARLESTOWN, MASSACHUSETTS

TABLE I
(Page 5 of 5)

HNU READING OF HEADSPACE IN SAMPLE JARS
FOR DETECTABLE VOLATILE ORGANIC COMPOUNDS

TEST PIT NUMBER	SAMPLE NUMBER	DEPTH (feet)	SAMPLE TYPE	HNU* SAMPLE (ppm)**	HNU* BACKGROUND (ppm)**
TP1	S1	0.0-6.7	FILL	1.4	0.4
	S2	6.7-10.0	SILT	0.6	0.4
TP2	S1	0.0-4.1	FILL	2.7	0.4
	S2	6.0-10.5	CLAY	0.6	0.4
TP3	S1	0.0-5.0	FILL	8.2	0.4
	S1a	5.0	CLAY	24.0	0.4
TP5	S1	0.0-4.0	FILL	0.6	0.4
TP6	S1	0.0-1.5	FILL	100.0	0.4
TP7	S1	0.0-4.0	FILL	2.6	0.4
TP8	S1	0.0-5.5	FILL	1.2	0.4
OT1	S1	0.0-3.2	FILL	1.2	0.4

TABLE II

6354-01
0015-17

CONCENTRATION OF CONTAMINANTS DETECTED
IN SOIL SAMPLES TESTED IN JANUARY 1988

Contaminant	Units	B100-S2	B100-S5	B101-S3	B102-S5	TP1-S1	TP2-S1	WORKING CRITERIA (DEQE)
Total Petroleum Hydrocarbons	ug/g (ppm)*	NT	26.0+	NT	100.0+	250.0	NT	100.0
EP Toxicity Metals	mg/l (ppm)	ND	NT	NT	NT	ND	ND	NA
Pesticides And PCBs	ug/kg (ppb)**	ND	NT	NT	NT	ND	ND	NA
Total Chloride	ug/g (ppm)	NT	NT	682	NT	NT	NT	250.0
Properties Tested								
pH	Unitless	NT	NT	7.6	NT	NT	NT	NSE

TABLE II (continued)

Contaminant	Units	TP2-S2	TP3-S1	TP3-S2	TP5-S2	WORKING CRITERIA (DEQE)
Total Petroleum Hydrocarbons	ug/g (ppm)*	NT	NT	350.0++	NT	100.0
EP Toxicity Metals	mg/l (ppm)	NT	ND	NT	NT	NA
Pesticides And PCBs	ug/kg (ppb)**	NT	ND	NT	NT	NA
Total Chloride	ug/g (ppm)	2,220	NT	NT	<62	250
Properties Tested						
pH	Unitless	7.4	NT	NT	6.4	NSE

ppm - Parts Per Million
ppb - Parts Per Billion
NT - Sample Was Not Tested For Indicated Contaminant
ND - None Detected
NSE - No Standard Established For This Contaminant or Property
NA - Not Applicable To This Site
+ - Total Petroleum Hydrocarbons Determined Using Infrared Method, EPA Method 418.1
++ - Total Petroleum Hydrocarbons Determined Using Gas Chromtography/Flame Ionization Method, U.S. Coast Guard Oil Spill Identification System

CONCENTRATION OF CONTAMINANTS DETECTED IN
GROUNDWATER SAMPLES OBTAINED ON 4 JANUARY 1988

Contaminant	Units	B2-OW	B4-OW	B100-OW	B101-OW	B102-OW	MCL	RMCL
Hazardous Substance List								
Semivolatile Organic Compounds								
Phenol	ug/l (ppb*)	NT	ND	ND	NT	Trace	NSE	NSE
Napthalene	ug/l (ppb)	NT	ND	ND	NT	110	NSE	NSE
2-Methylnapthalene	ug/l (ppb)	NT	ND	ND	NT	21	NSE	NSE
N-Nitrosodiphenylamine	ug/l (ppb)	NT	ND	Trace	NT	Trace	NSE	NSE
Pesticides And PCBs	ug/l (ppb)	NT	ND	ND	NT	ND	NA	NA
Hazardous Substance List								
Volatile Organic Compounds								
Benzene	ug/l (ppb)	ND	ND	ND	NT	170	5+	5
Ethylbenzene	ug/l (ppb)	ND	ND	ND	NT	280	NSE	680
Total Xylenes	ug/l (ppb)	ND	ND	ND	NT	470	NSE	440
Priority Pollutant Metals								
Arsenic	mg/l (ppm**)	NT	0.017	ND	ND	0.0077	0.05	0.05
Beryllium	mg/l (ppm)	NT	0.0035	ND	ND	ND	NSE	NSE
Chromium	mg/l (ppm)	NT	0.20	ND	ND	ND	0.05	0.12
Copper	mg/l (ppm)	NT	0.33	ND	ND	ND	1.0	1.3
Lead	mg/l (ppm)	NT	0.17	ND	ND	ND	0.05	0.02
Mercury	mg/l (ppm)	NT	0.00035	ND	ND	ND	0.002	0.003
Nickel	mg/l (ppm)	NT	0.13	ND	ND	ND	NSE	NSE
Selenium	mg/l (ppm)	NT	ND	0.0089	0.0058	ND	0.01	0.045
Zinc	mg/l (ppm)	NT	0.47	0.015	ND	0.01	5.0	5.0
Total Cyanide	mg/l (ppm)	0.015	<0.01	<0.01	NT	<0.01	NSE	NSE
Total Petroleum Hydrocarbons	mg/l (ppm)	1.3	0.7	ND	NT	1.6	NSE	NSE

* Parts Per Billion - ppb

** Parts Per Million - ppm

ND - None Detected

NT - Not Tested

MCL - Maximum Contaminant Level: Enforceable EPA/Massachusetts Groundwater or Drinking Water Standard

RMCL - Recommended Maximum Contaminant Level: EPA Recommended Non-enforceable Groundwater or Drinking Water Standard Likely To Become An Enforceable Standard

NSE = No Standard Established For This Contaminant Or Property

NA - Not Applicable To This Site

+ Drinking Water Standard To Take Effect On 31 December 1988

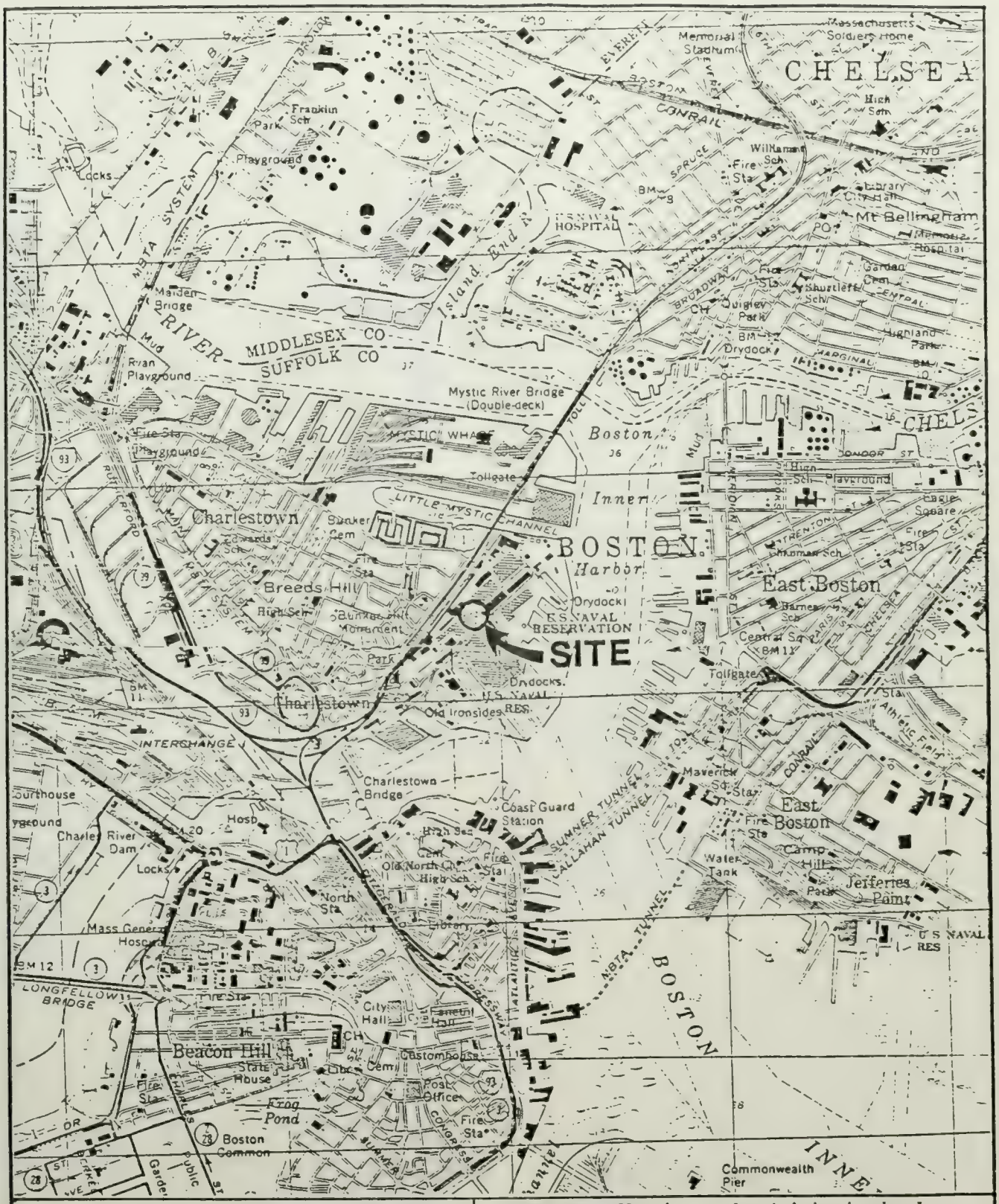
References:

1 - 314 CMR Massachusetts Groundwater Quality Standards.

2 - National Interim Primary And Secondary Drinking Water Regulations: 1 August 1986 "Environmental Reporter".

3 - EPA Proposed MCL For Drinking Water, "Environmental Reporter", 15 November 1985.

4 - "Handbook of Toxic and Hazardous Chemicals and Carcinogens", Second Edition, Marshall Sittig, Noyes Publications, Park Riad, NS, 1985.



SITE COORDINATES: 42°22'35"N 71°03'13"W

U.S.G.S. QUADRANGLE: BOSTON NORTH, MA

Haley & Aldrich, Inc.
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

OIL AND HAZARDOUS MATERIAL SITE EVALUATION
PARCELS 39A AND 150
BOSTON NAVAL SHIPYARD
CHARLESTOWN, MASSACHUSETTS

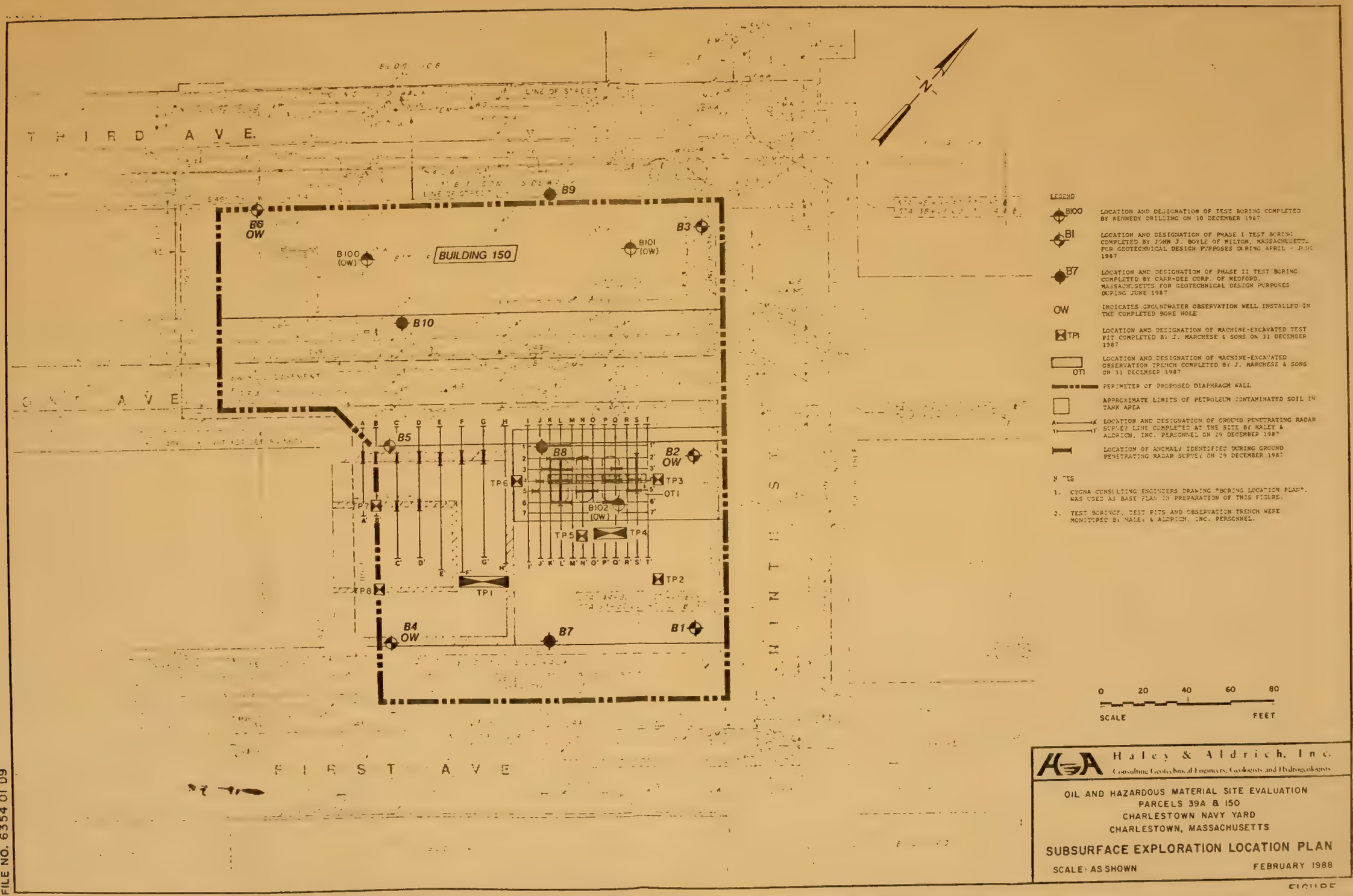
PROJECT LOCUS

APPROX. SCALE 1:25,000

MARCH 1988

FILE NO. 0354-01 A1

FIGURE 1



Haley & Aldrich, Inc.
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

OIL AND HAZARDOUS MATERIAL SITE EVALUATION
PARCELS 39A & 150
CHARLESTOWN NAVY YARD
CHARLESTOWN, MASSACHUSETTS

SUBSURFACE EXPLORATION LOCATION PLAN

SCALE: AS SHOWN FEBRUARY 1988

FIGURE

FILE NO. 6354 01 09

APPENDIX A

Test Boring Logs

Boring Report

a Consulting Engineers
Congress Street
ton, Massachusetts

John J. Boyle
80 Martin Road
Milton, Mass.

TOWN Charlestown Navy Yard
PROJECT NAME Parcels 150 and 39A
PROJECT NO.

SHEET 1 OF 2
LOCATION
HOLE NO. B 1
LINE & STA.
OFFSET

GROUND WATER OBSERVATIONS
ft. after Hours
' at completion
ft. after Hours

	CASING	SAMPLER	CORE BAR.
Type	Auger	SS	
Size I.D.	3 3/4"	1 3/8"	
Hammer Wt.		140#	BIT.
Hammer Fall		30"	

SURFACE ELEV. 17.75
DATE FINISH 6/3/87
BORING FOREMAN G. Taylor
INSPECTOR P. Richards
SOILS ENGR. Haley & Aldrich

LOCATION OF BORING:

th ow face	Casing Blows per foot	Sample Depths From-To	Blows per 6" on Sampler From-To 0-6	6-12	12-18	18-24	Strata Change Depth Elev.	Field Indentification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
		0'-2'	7	12	19	29			1		
		2'-4'	19	10	9	9			2		
5'		4'-6'	15	15	18	19		Fill (Samples taken by Haley & Aldrich)	3		
							10'				
0'		10'-12'	20	40	48	44			4		
								Very dense to dense gray-brown silt and clay, some gravel, trace of fine sand			
5'		15'-17'	20	18	32	17			5		
		18'-19.5'	12	13	17				6		
20'							23'				
		23'-24.5'	13	13	17			Dense coarse brown sand and gravel, trace of silt	7		
25'							25'				
		25'-27'	19	19	21	24			8		
30'		30'-32'	30	30	32	36		Dense to very dense gray silt, some clay and fine gravel, trace of sand and cobbles	9		
35'		35'-37'	16	24	35	44			10		
40'							40'				

GROUND SURFACE TO FT., USED " CASING; THEN " CASING TO FT.

D = DRY W = WASHED C = CORED P = PIT A = AUGER UP = UNDISTURBED, PISTON
UB = UNDISTURBED, BALL CHECK V = VANE TEST

Boring Report

Consulting Engineers
Congress Street
on, Massachusetts

John J. Boyle
80 Martin Road
Milton, Mass.

TOWN Charlestown Navy Yard
PROJECT NAME Parcels 150 and 39A
PROJECT NO.

SHEET 2 OF 2
LOCATION
HOLE NO. B 1
LINE & STA.
OFFSET

GROUND WATER OBSERVATIONS
ft. after Hours
at completion
ft. after Hours

	CASING	SAMPLER	CORE BAR.
Type	Auger	SS	
Size I.D.	3 3/4"	1 3/8"	
Hammer Wt.		140#	BIT.
Hammer Fall		30"	

SURFACE ELEV. 17.75
DATE FINISH 6/3/87
BORING FOREMAN G. Taylor
INSPECTOR P. Richards
SOILS ENGR. Haley & Aldrich

LOCATION OF BORING:

Casing Blows per foot	Sample Depths From-To	Blows per 6" on Sampler From 0-6	6-12	To 12-18	18-24	Strata Change Depth Elev.	Field Identification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
	40'-42'	31	31	39	40			11		
	45'-47'	48	48	59	62		Very dense gray silt, some clay and fine gravel, trace of fine sand	12		
	50'-52'	38	42	49	51			13		
	55'-57'	29	34	51	62			14		
	58'-60'	31	35	40	53			15		
						60'	Bottom of boring 60'			

Note:
In obtaining elevation I took platform at top of steps to Morse Diesel Building - Ninth Street entrance at elevation 20.00 for bench mark.

GROUND SURFACE TO FT., USED " CASING; THEN " CASING TO FT.

D = DRY W = WASHED C = CORED P = PIT A = AUGER UP = UNDISTURBED, PISTON
UB = UNDISTURBED, BALL CHECK V = VANE TEST

Boring Report

Consulting Engineers
ongress Street
n, Massachusetts

John J. Boyle
80 Martin Road
Milton, Mass.

TOWN Charlestown Navy Yard
PROJECT NAME Parcels 150 and 39A
PROJECT NO.

SHEET 1 OF 2
LOCATION
HOLE NO. B 2
LINE & STA.
OFFSET

GROUND WATER OBSERVATIONS
ft. after Hours
10'
ft. after Hours

	CASING	SAMPLER	CORE BAR.
Type	Flush	SS	
Size I.D.	3"	1 3/8"	
Hammer Wt.	400#	140#	BIT.
Hammer Fall	24"	30"	

SURFACE ELEV. 17.75
DATE FINISH 5/29/87
BORING FOREMAN G. Taylor
INSPECTOR T. Cormican
SOILS ENGR. Haley & Aldrich

LOCATION OF BORING:

Casing Blows per foot	Sample Depths From-To	Blows per 6" on Sampler From 0-6	6-12	To 12-18	18-24	Strata Change Depth Elev.	Field Identification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
	0"-2'	2	16	22	22	2'	Dense medium to fine sand, some silt and gravel	1		
	2'-4'	11	9	8	10		Medium dense fine brown sand and silt, trace of clay	2		
	4'-6'	19	10	10	32	6'		3		
	6'-8'	39	25	22	27		Very dense gray-brown silt, some clay, fine sand and gravel	4		
	8'-10'	25	25	80	23	10'		5		
	10'-12	9	19	20	20		Hard yellow clay, some silt and gravel, trace of fine sand	6		
	15'-17	15	15	20	25	20'		NR		
	20'-22	11	12	13	21		Dense to very dense gray clay, some silt and gravel, trace of fine sand	7		
	25'-27	20	43	14	22			8		
	30'-32	9	13	28	23			9		
	35'-37	20	20	30	35	40'		10		

GROUND SURFACE TO ____ FT., USED ____ "CASING; THEN ____ "CASING TO ____ FT.

D = DRY W = WASHED C = CORED P = PIT A = AUGER UP = UNDISTURBED, PISTON
UB = UNDISTURBED, BALL CHECK V = VANE TEST

Boring Report

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ongress Street
on, Massachusetts

John J. Boyle
80 Martin Road
Milton, Mass.

TOWN Charlestown Navy Yard
PROJECT NAME Parcels 150 and 93A
PROJECT NO.

SHEET 2 OF 2
LOCATION
HOLE NO. B 2
LINE & STA.
OFFSET

GROUND WATER OBSERVATIONS
ft. after Hours
10'
ft. after Hours

	CASING	SAMPLER	CORE BAR.
Type	Flush	SS	
Size I.D.	3"	1 3/8"	
Hammer Wt.	400#	140#	BIT.
Hammer Fall	24"	30"	

SURFACE ELEV. 17.75
DATE FINISH 5/29/87
BORING FOREMAN G. Taylor
INSPECTOR T. Cormican
SOILS ENGR. Haley & Aldrich

LOCATION OF BORING:

h w ace	Casing Blows per foot	Sample Depths From-To	Blows per 6" on Sampler From 0-6	6-12	To 12-18	18-24	Strata Change Depth Elev.	Field Identification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
		40'-42"	49	38	48	50			NR		
		45'-47"	40	55	85	90			11		
		50'-52"	10	15	38	49		Very dense gray silt, some fine to coarse gravel, trace of clay and fine sand	12		
		55'-57"	40	50	66	120 for 2"			13		
		60'-61.5"	34	42	120	for 5"	61.5'		14		
								Bottom of boring 61.5'			
								Installed 2" PVC well at 15' Used: 10'-2" PVC screen 5'-2" PVC pipe 3 bags sand bentonite Lock type gate box Set in concrete			

GROUND SURFACE TO ____ FT., USED ____ "CASING; THEN ____ "CASING TO ____ FT.

D = DRY W = WASHED C = CORED P = PIT A = AUGER UP = UNDISTURBED, PISTON
UB = UNDISTURBED, BALL CHECK V = VANE TEST

Boring Report

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...6 Congress Street
...on, Massachusetts

John J. Boyle
80 Martin Road
Milton, Mass.

TOWN Charlestown Navy Yard
PROJECT NAME Parcels 150 and 39A
PROJECT NO.

SHEET 1 OF 2
LOCATION
HOLE NO. B 3
LINE & STA.
OFFSET

GROUND WATER OBSERVATIONS
___ ft. after ___ Hours
___ ft. after ___ Hours

	CASING	SAMPLER	CORE BAR.
Type	BW	SS	
Size I.D.	2½"	1 3/8"	
Hammer wt.	400#	140#	BIT.
Hammer Fall	24"	30"	

SURFACE ELEV. 18.45
DATE FINISH 4/29/37
BORING FOREMAN G. Taylor
INSPECTOR R. Varnum
SOILS ENGR. Haley & Aldrich

LOCATION OF BORING:

...h ...w ...ace	Casing Blows per foot	Sample Depths From-To	Blows per 6" on Sampler From 0-6	From 6-12	To 12-18	To 18-24	Strata Change Depth Elev.	Field Indentification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
		0'-2'	3	9	21	21	2'	Top soil and sub soil	1		
		2'-4'	12	8	8	7	4'	Sandy brown clay fill	2		
5'		4'-6'	12	14	21	24		Hard sandy brown clay	3		
10'		10'-12'	24	34	34	28	15'		4		
15'		15'-17'	22	24	58	22			5		
20'		20'-22'	9	11	14	22			6		
25'		25'-27'	24	25	35	37		Compact to very compact fine gray-brown sand, gravel, silt and clay (till)	7		
30'		30'-32'	20	22	31	38			8		
35'		35'-37'	22	23	30	34			9		
40'							40'				

GROUND SURFACE TO ___ FT., USED ___ "CASING THEN ___ "CASING TO ___ FT.

D = DRY W = WASHED C = CORED P = PIT A = AUGER UP = UNDISTURBED, PISTON
UB = UNDISTURBED, BALL CHECK V = VANE TEST

... 30% or less ... = 40-30%, and 50% - 40%

HOLE NO. ...

Boring Report

Consulting Engineers
Congress Street
Massachusetts

John J. Boyle
80 Martin Road
Milton, Mass.

TOWN Charlestown Navy Yard
PROJECT NAME Parcels 150 and 39A
PROJECT NO.

SHEET 2 OF 2
LOCATION
HOLE NO. B-3
LINE & STA.
OFFSET

GROUND WATER OBSERVATIONS
ft. after Hours
ft. after Hours

	CASING	SAMPLER	CORE BAR.
Type	BW	SS	
Size I.D.	2½"	1 3/8"	
Hammer wt.	400#	140#	BIT.
Hammer Fall	24"	30"	

SURFACE ELEV.
DATE FINISH 5/27/97
BORING FOREMAN G. Taylor
INSPECTOR T. Cormican
SOILS ENGR. Haley & Aldrich

LOCATION OF BORING:

ce	Casing Blows per foot	Sample Depths From-To	Blows per 6" on Sampler From 0-6	6-12	To 12-18	18-24	Strata Change Depth Elev.	Field Indentification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
		40'-41"	86	100					10		
								Very compact fine gray sand, gravel, silt and clay			
		45'-47"	18	22	28	34			11		
							50'				
		50'-52"	30	40	120				12		
								Cemented gray silt, some gravel, trace of fine sand and clay			
		55'-57"							NR		
		58'-60"	24	71	97	87			13		
							60'				
								Bottom of boring 60'			

GROUND SURFACE TO FT., USED "CASING; THEN "CASING TO FT.

D = DRY W = WASHED C = CORED P = PIT A = AUGER UP = UNDISTURBED, PISTON
UB = UNDISTURBED, BALL CHECK V = VANE TEST

30% or less, some = 40-30%, and 50% -40%

HOLE NO. B-3

Boring Report

na Consulting Engineers
Congress Street
on, Massachusetts

John J. Boyle
80 Martin Road
Milton, Mass.

TOWN Charlestown Navy Yard
PROJECT NAME Parcels 150 and 39A
PROJECT NO.

SHEET 1 OF -
LOCATION
HOLE NO. B 4
LINE & STA.
OFFSET

GROUND WATER OBSERVATIONS
ft. after Hours
6.7'
ft. after Hours

	CASING	SAMPLER	CORE BAR.
Type	Auger	SS	
Size I.D.	3 3/4"	1 3/8"	
Hammer Wt.		140#	BIT.
Hammer Fall		30"	

SURFACE ELEV. 17.62
DATE FINISH 6/2/87
BORING FOREMAN R. Jones
INSPECTOR T. Corrican
SOILS ENGR. Haley & Aldrich

LOCATION OF BORING:

Casing Blows per foot	Sample Depths From-To	Blows per 6" on Sampler From 0-6	6-12	To 12-18	18-24	Strata Change Depth Elev.	Field Indentification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
							4" Concrete			
0.6	1'-2.5'	5	20	25	13		Dense black-brown fine to medium sand, some gravel, trace of wood	1	24	14
2.5	2'-3.5"	55	61	120-0"			Very dense brown fine sand and silt, trace of gravel	2	12	8
	5'-7'	6	5	4	16		Loose dark brown fine to medium sand, some silt, trace of gravel	3	24	7
	7'-9'	30	41	80	14		Very dense brown silt, some fine sand and gravel	4	24	10
	9'-11'	11	24	36	34		Dense black fine sand, some silt, gravel and wood	5	24	12
	11'-13'	19	19	6	4	13'	"A"	6	24	18
	13'-15'	9	11	15	24		Very stiff brown silty clay	7	24	20
	18'-20'	6	9	11	14		Very stiff brown cilty clay	8	24	20
	23'-25"	6	7	10	11		Very stiff brown silty clay, trace of gravel	9	24	10
						27'				
	28'-30"	13	28	22	25		Dense gray silt and clay, trace of fine gravel and sand	10	24	15
						33'				
33	'-34.5"		25	48	57		Very dense gray silt, some gravel, trace of fine sand and clay	11	18	3
	38'-39'	28	140				Very dense gray silt, some clay and gravel, trace of fine sand	12	12	10

GROUND SURFACE TO ____ FT., USED ____ "CASING!

"A"-Very dense black fine sand and gravel, some silt, trace of wood

D = DRY W = WASHED C = CORED P = PIT
UD = UNDISTURBED, BALL CHECK V =

Boring Report

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Milton, Mass.

TOWN Charlestown Navy Yard
PROJECT NAME Parcels 150 and 39A
PROJECT NO.

SHEET 2 OF 2
LOCATION
HOLE NO. B 4
LINE & STA.
OFFSET

GROUND WATER OBSERVATIONS
ft. after Hours
6.7'
ft. after Hours

	CASING	SAMPLER	CORE BAR.
Type	Auger	SS	
Size I.D.	3 3/4"	1 3/8"	
Hammer wt.		140#	BIT.
Hammer Fall		30"	

SURFACE ELEV. 17.62
DATE FINISH 6/2/87
BORING FOREMAN R. Jones
INSPECTOR T. Cormican
SOILS ENGR. Haley & Aldrich

LOCATION OF BORING:

Casing Blows per foot	Sample Depths From-To	Blows per 6" on Sampler From 0-6	6-12	To 12-18	18-24	Strata Change Depth Elev.	Field Identification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
	43'-44.5"	25	31	43			Very dense gray silt, some clay and gravel, trace of fine sand	13	18	8
						48'				
	48'-49.5"	33	48	57				14	18	9
	53'-54.5"	34	42	91				NR	18	0
							Very dense gray silt, some gravel, trace of fine sand and clay			
	58.5'-60"	46	59	66				15	18	10
						60'				
							Bottom of boring 60'			

GROUND SURFACE TO FT., USED "CASING; THEN "CASING TO FT.

D = DRY W = WASHED C = CORED P = PIT A = AUGER UP = UNDISTURBED, PISTON
UB = UNDISTURBED, BALL CHECK V = VANE TEST

Boring Report

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Congress Street
on, Massachusetts

John J. Boyle
80 Martin Road
Milton, Mass.

TOWN Charlestown Navy Yard
PROJECT NAME Parcels 150 and 39A
PROJECT NO.

SHEET 1 OF 1
LOCATION
HOLE NO. B 4A
LINE & STA. 1' from B 4
OFFSET

GROUND WATER OBSERVATIONS
ft. after Hours
ft. after Hours

	CASING	SAMPLER	CORE BAR.
Type	Auger		
Size I.D.	3 3/4"		
Hammer wt.			BIT.
Hammer Fall			

SURFACE ELEV. 17.62
DATE FINISH 6/2/87
BORING FOREMAN R. Jones
INSPECTOR T. Cormican
SOILS ENGR.

LOCATION OF BORING:

th ow face	Casing Blows per foot	Sample Depths From-To	Blows per 6" on Sampler From 0-6	6-12	To 12-18	18-24	Strata Change Depth Elev.	Field Indentification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
								Auger			
5'								No sampling			
0'											
5'							15'				
								Bottom of well 15'			
								Installed 2" well at 15'			
								Used:			
								10' screen 2" PVC 5' - 2" PVC pipe 6 Bags of sand 15 lbs. pelletts 1 Road box (lock type) set in concrete			

GROUND SURFACE TO FT., USED "CASING; THEN "CASING TO FT.

D = DRY W = WASHED C = CORED P = PIT A = AUGER UP = UNDISTURBED, PISTON
UB = UNDISTURBED, BALL CHECK V = VANE TEST

Boring Report

a Consulting Engineers
Congress Street
ston, Massachusetts

John J. Boyle
80 Martin Road
Milton, Mass.

TOWN Charlestown Navy Yard
PROJECT NAME Parcels 150 and 39A
PROJECT NO.

SHEET 1 OF 2
LOCATION
HOLE NO. B 5
LINE & STA.
OFFSET

GROUND WATER OBSERVATIONS
ft. after Hours
ft. after Hours

	CASING	SAMPLER	CORE BAR.
Type	Auger	SS	
Size I.D.	3 3/4"	1 3/8"	
Hammer Wt.		140#	BIT.
Hammer Fall		30"	

SURFACE ELEV. 17.55
DATE FINISH 6/3/87
BORING FOREMAN R. Jones
INSPECTOR P. Richards
SOILS ENGR. Haley & Aldrich

LOCATION OF BORING:

th ow face	Casing Blows per foot	Sample Depths From-To	Blows per 6" on Sampler From 0-6	6-12	To 12-18	18-24	Strata Change Depth Elev.	Field Identification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
		0"-2'	2	10	20	23		Dense brown fine sand, some gravel, trace of silt	1	24	8
		2'-4'	48	42	30	19		Very dense miscellaneous fill, red brick concrete	2	24	4
'		4'-6'	12	4	5	5		Loose brown silt, some fine sand and gravel, trace of red bricks & clay	3	24	9
		6'-8'	5	5	2	1		Loose brown silt, some gravel, trace of wood	4	24	7
		8'-9'	2	6				Loose gray fine sand, silt, some	5	12	6
0'		9'-10'	10	16			"A"	clay and wood	5A	12	8
		10'-11'	7	5			11'	"B"	6	12	12
		11'-12'	13	19				Very hard brown silty clay	6A	12	5
5'		15'-17'	12	13	14	14			7	24	24
								Very stiff brown silty clay			
0'		20'-22'	7	7	8	10			8	24	24
							24.5'				
5'		25'-27'	5	11	14	15			9	24	1
								Very dense gray silt, some clay and gravel, trace of fine sand			
0'		30'-32'	9	16	25	27			10	24	1
5'							35'				
		35'-37'	9	14	18	20		Dense gray silt, some gravel, trace of fine sand and clay	11	24	1
0'											

GROUND SURFACE TO FT., USED "

D = DRY W = WASHED C = CORED P = PIT
UB = UNDISTURBED, BALL CHECK V = `

"A"-Very stiff brown-blue silty clay .
"B"-Medium dense black fine sand and silt, som wood and clay

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TOWN Charlestown Navy Yard

PROJECT NAME Parcels 150 and 39A

PROJECT NO.

SHEET 2 OF 2

LOCATION

HOLE NO. B 5

LINE & STA.

OFFSET

GROUND WATER OBSERVATIONS

ft. after Hours

ft. after Hours

	CASING	SAMPLER	CORE BAR.
Type	AUGER	SS	
Size I.D.	3 3/4"	1 3/8"	
Hammer Wt.		140#	BIT.
Hammer Fall		30"	

SURFACE ELEV. 17.55

DATE FINISH 6/3/87

BORING FOREMAN R. Jones

INSPECTOR P. Richards

SOILS ENGR. Haley & Aldrich

LOCATION OF BORING:

ch ow Face	Casing Blows per foot	Sample Depths From-To	Blows per 6" on Sampler From 0-6	6-12	To 12-18	18-24	Strata Change Depth Elev.	Field Indentification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
		40'-42'	25	20	30	33			12	24	10
		45'-46.5'	22	39	51			Very dense gray silt, some clay and gravel, trace of fine sand	13	18	9
		50'-52.5'	18	20	48				14	18	6
		55'-56.5'	17	20	64				15	18	15
		58.5'-60'	30	32	68		60'		16	18	14
								Bottom of boring 60'			

GROUND SURFACE TO ____ FT., USED ____ " CASING; THEN ____ " CASING TO ____ FT.

D = DRY W = WASHED C = CORED P = PIT A = AUGER UP = UNDISTURBED, PISTON
UB = UNDISTURBED, BALL CHECK V = VANE TEST

Boring Report

Consulting Engineers
Congress Street
, Massachusetts

John J. Boyle
80 Martin Road
Milton, Mass.

TOWN Charlestown Navy Yard
PROJECT NAME Parcels 150 and 39A
PROJECT NO.

SHEET 1 OF 2
LOCATION
HOLE NO. B 6
LINE & STA.
OFFSET

ROUND WATER OBSERVATIONS
ft. after Hours
" - 8:00 A.M. - 5/4/87
ft. after Hours

	CASING	SAMPLER	CORE BAR.
Type	Hollow Stem Auger	SS	
Size I.D.	3 3/4"	1 3/8"	
Hammer Wt.	—	140#	BIT.
Hammer Fall	—	30"	

SURFACE ELEV. 18.65
DATE FINISH 4/29/87
BORING FOREMAN J. Marks
INSPECTOR R. Varnum
SOILS ENGR. Haley & Aldrich

CATION OF BORING:

Casing Blows per foot	Sample Depths From-To	Blows per 6" on Sampler From 0-6	6-12	To 12-18	18-24	Strata Change Depth Elev.	Field Indentification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
	1'-3'	5	7	9	11			1		12"
							Mixed fill			
	3'-5'	10	12	16	18			2		10"
						5'				
	5'-7'	14	16	19	22			3		12"
						7'	Sandy gray clay, some peat and fill			
	7'-9'	15	18	21	27			4		12"
	10'-12'	6	10	19	21			5		18"
							Hard sandy brown clay			
	15'-17'	5	10	13	18			6		24"
	20'-22'	6	10	12	12			7		24"
						25'6"				
	25'6"-27'6"	14	20	34	37			8		14"
	30'-32'	13	29	46	25		Very compact fine gray-brown sand, gravel and silt, some clay (till)	9		20"
	35'-37'	18	34	40	73			10		22"

GROUND SURFACE TO FT., USED "CASING THEN "CASING TO FT.

D = DRY W = WASHED C = CORED P = PIT A = AUGER UP = UNDISTURBED, PISTON
UB = UNDISTURBED, BALL CHECK V = VANE TEST

Boring Report

...n Consulting Engineers
...6 Congress Street
...on, Massachusetts

John J. Boyle
80 Martin Road
Milton, Mass.

TOWN Charlestown Navy Yard
PROJECT NAME Parcels 150 and 39A
PROJECT NO.

SHEET 2 OF 2
LOCATION
HOLE NO. B 6
LINE & STA.
OFFSET

GROUND WATER OBSERVATIONS
...ft. after ... Hours
-1" - 8:00 A.M. - 5/4/87
...ft. after ... Hours

	CASING	SAMPLER	CORE BAR.
Type	Hollow Stem Auger	SS	
Size I.D.	3 3/4"	1 3/8"	
Hammer Wt.	—	140#	BIT.
Hammer Fall	—	30"	

SURFACE ELEV. 18.65
DATE FINISH 4/29/87
BORING FOREMAN J. Marks
INSPECTOR R. Varnum
SOILS ENGR. Haley & Aldrich

LOCATION OF BORING:

...ce	Casing Blows per foot	Sample Depths From-To	Blows per 6" on Sampler From 0-6	6-12	To 12-18	18-24	Strata Change Depth Elev.	Field Identification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
		40'-42"	21	30	47	51			11		20"
		45'-47"	56	90	95	110		Very compact fine gray-brown sand, gravel and silt, some clay (till)	12		22"
		50'-52"	31	46	87	120			13		
							52'	Bottom of boring 52' (Refusal material)			

Installed 15' long (10 slot) 2" diameter PVC monitor well screen at 35'. Packed with filter sand and sealed at top with bentonite. Encased in Buffalo Box for protection and set in concrete.

GROUND SURFACE TO ... FT., USED ... "CASING; THEN ... "CASING TO ... FT.

D = DRY W = WASHED C = CORED P = PIT A = AUGER UP = UNDISTURBED, PISTON
UB = UNDISTURBED, BALL CHECK V = VANE TEST

CARR-DEE CORP.
37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone 391-4500

To HALEY & ALDRICH, INC., CAMBRIDGE, MA. 02142 Date June 26, 1987 Job No 87475

Location CHARLESTOWN NAVY YARD, CHARLESTOWN, MASS. Scale 1" = 3 ft.

BORING B7

GROUND SURFACE

FILL SAND, GRAVEL, COBBLES, BRICK	4 10 13 13	S#1, FROM G.S. TO 2'0" RECOVERED 6"
	20 8 17 11	S#2, FROM 2'0" TO 4'0" RECOVERED 10"
	3 5 4 3	S#3, FROM 5'0" TO 7'0" RECOVERED 9"
	6 11 20 24	S#4, FROM 7'0" TO 9'0" RECOVERED 8"
10'0"		
VERY STIFF	8 9 13 15	S#5, FROM 10'0" TO 12'0" RECOVERED 7"
YELLOW CLAY AND GRAVEL	10 7 13 15	S#6, FROM 15'0" TO 17'0" RECOVERED 8"
	19 13 14 16	S#7, FROM 20'0" TO 22'0" RECOVERED 8"
23'0"		

(CONTINUED ON SHEET 2)

CARR-DEE CORP.
37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone 391-4500

To HALEY & ALDRICH, INC, CAMBRIDGE, MA. 02142 Date JUNE 26, 1987 Job No 87475

Location CHARLESTOWN NAVY YARD, CHARLESTOWN, MA. Scale 1" = 3 ft.

BORING B 7 (CONTINUED)

23'0"	STIFF BLUE CLAY, SOME GRAVEL	6 5 5 6	S#8, FROM 25'0" TO 27'0" RECOVERED 10"
28'6"	VERY STIFF CLAYEY FINE SAND, GRAVEL, COBBLES	12 11 19 14 21 19 19 20	S#9, FROM 30'0" TO 32'0" NO RECOVEREY S#10, FROM 35'0" TO 37'0" RECOVERED 9"
	VERY DENSE FINE TO MEDIUM SAND, GRAVEL, CLAY, TRACE SILT	15 18 33 44 25 30 46 57	S#11, FROM 40'0" TO 42'0" RECOVERED 15" S#12, FROM 45'0" TO 47'0" RECOVERED 13"
48'0"			

(CONTINUED ON SHEET 3)

CARR-DEE CORP.
37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone 391-4500

To HALEY & ALDRICH, INC, CAMBRIDGE, MA. 02142 Date JUNE 26, 1987 Job No 87475

Location CHARLESTOWN NAVY YARD, CHARLESTOWN, MA. Scale 1" = 3 ft.

BORING B 7 (CONTINUED)

48'0"

VERY DENSE	16 25 81 50	S#13, FROM 50'0" TO 52'0" RECOVERED 8"
FINE TO MEDIUM		
SAND, GRAVEL,		
	27 38 59	S#14, FROM 55'0" TO 57'0" RECOVERED 10"
CLAY, TRACE	71	
SILT		
	31 43 58	S#15, FROM 60'0" TO 62'0" RECOVERED 7"

62'0" 71

WATER LEVEL NOT RECORDED
SIZE OF CASING NW, LENGTH 12'0"
DRILLER: L. KNOX, INSPECTOR: P. RICHARDS
DATE STARTED & COMPLETED: 6-10-87

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in right hand column indicate number of blows required to drive two-inch split sampler 6 inches using 140 lb. weight falling 30 inches ±. Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches ±.

CARR-DEE CORP.

37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone 391-4500

To HALEY & ALDRICH, INC, CAMBRIDGE, MA. 02142 Date JUNE 26, 1987 Job No 87475

Location CHARLESTOWN NAVY YARD, CHARLESTOWN, MA. Scale 1" = 3 '

BORING B 8

GROUND SURFACE

FILL LOAM, SAND, GRAVEL, COBBLES, BRICK, ASH, CONCRETE	1 4 18 30	S#1, FROM G.S. TO 2'0" RECOVERED 8"
	16 13 11 5	S#2, FROM 2'0" TO 4'0" RECOVERED 6"
	3 3 5 6	S#3, FROM 4'0" TO 6'0" RECOVERED 6"
	7 11 14 14	S#4, FROM 6'0" TO 8'0" RECOVERED 7"
	12 13 15 11	S#5, FROM 8'0" TO 10'0" RECOVERED 18"
10'0"		
VERY STIFF YELLOW CLAY AND GRAVEL	6 8 11 13	S#6, FROM 10'0" TO 12'0" RECOVERED 12"
15'0"		
HARD	16 32 39 47	S#7, FROM 15'0" TO 17'0" RECOVERED 12"
YELLOW CLAY,		
GRAVEL, COBBLES	12 19 17 11	S#8, FROM 20'0" TO 22'0" RECOVERED 12"
24'0"		

(CONTINUED ON SHEET 2)

CARR-DEE CORP.
37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone 391-4500

To HALEY & ALDRICH, INC, CAMBRIDGE, MA. 02142 Date JUNE 26, 1987 Job No 87475

Location CHARLESTOWN NAVY YARD, CHARLESTOWN, MA. Scale 1" = 3 ft.

BORING B8 (CONTINUED)

24'0"		
	VERY STIFF	8
		11
	YELLOW CLAY,	13
		19
	GRAVEL, COBBLES	S#9, FROM 25'0" TO 27'0" RECOVERED 9"
		13
		18
	DENSE TO	20
		26
	VERY DENSE	S#10, FROM 30'0" TO 32'0" RECOVERED 6"
		17
		17
	FINE TO MEDIUM	33
		49
	SAND, GRAVEL,	S#11, FROM 35'0" TO 37'0" RECOVERED 5"
		15
		19
	COBBLES, SOME	30
		33
	CLAY AND SILT	S#12, FROM 40'0" TO 42'0" RECOVERED 5"
		21
		36
		39
		81
48'0"		S#13, FROM 45'0" TO 47'0" RECOVERED 7"

(CONTINUED ON SHEET 2)

CARR-DEE CORP.
37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone 391-4500

To HALEY & ALDRICH, INC, CAMBRIDGE, MA. 02142 Date JUNE 26, 1987 Job No 87475

Location CHARLESTOWN NAVY YARD, CHARLESTOWN, MA. Scale 1" = 3 ft.

BORING B 8 (CONTINUED)

48'0"			
	VERY DENSE	18	S#14, FROM 50'0" TO 52'0"
	FINE TO MEDIUM	22	RECOVERED 4"
		33	
	SAND, GRAVEL,	41	
	COBBLES, SOME		
	CLAY AND SILT	31	S#15, FROM 55'0" TO 57'0"
		33	RECOVERED 8"
		46	
57'0"		69	

WATER LEVEL 8'6"
SIZE OF CASING NW, LENGTH 10'0"
DRILLER: L. KNOX, INSPECTOR: P. RICHARDS
DATE STARTED & COMPLETED: 6-9-87

All samples have been visually classified by DRILLER Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in right hand column indicate number of blows required to drive two-inch split sampler 6 inches using 140 lb. weight falling 30 inches ±. Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches ±.

CARR-DEE CORP.

37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone 391-4500

To HALEY & ALDRICH, INC, CAMBRIDGE, MA. 02142 Date JUNE 26, 1987 Job No 87475

Location CHARLESTOWN NAVY YARD, CHARLESTOWN, MA. Scale 1" = 3 ft.

BORING B 9

GROUND SURFACE

0'6"	ASPHALT		
	FILL	5 30 58 60	S#1, FROM 0'6" TO 2'6" RECOVERED 14"
		36 32 25 15	S#2, FROM 2'6" TO 4'6" RECOVERED 9"
5'6"		7 8	S#3, FROM 4'6" TO 5'6" RECOVERED 6"
	VERY STIFF TO HARD YELLOW CLAY	9 15 18 21 23 29	S#3A, FROM 5'6" TO 6'6" RECOVERED 7" S#4, FROM 6'6" TO 8'6" RECOVERED 9"
	VERY STIFF YELLOW CLAY	9 9 11 14	S#5, FROM 8'6" TO 10'6" RECOVERED 7"
12'0"			
	DENSE FINE TO MEDIUM SILTY SAND	23 20 22 24	S#6, FROM 15'0" TO 17'0" RECOVERED 9"
	AND GRAVEL, SOME YELLOW CLAY	9 16 17 18	S#7, FROM 20'0" TO 22'0" RECOVERED 4"
25'0"			

(CONTINUED ON SHEET 2)

CARR-DEE CORP.
37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone 391-4500

To HALEY & ALDRICH, INC, CAMBRIDGE, MA. 02142 Date JUNE 26, 1987 Job No 87475

Location CHARLESTOWN NAVY YARD, CHARLESTOWN, MA. Scale 1" = 3 ft.

BORING B 9 (CONTINUED)

25'0"			
		14 14 17 19	S#8, FROM 25'0" 27'0" RECOVERED 10"
	DENSE FINE TO MEDIUM		
		13 18 16 21	S#9, FROM 30'0" TO 32'0" RECOVERED 2"
	SILTY SAND AND GRAVEL, SOME YELLOW CLAY		
		11 13 18 23	S#10, FROM 35'0" TO 37'0" RECOVERED 11"
	VERY DENSE FINE TO MEDIUM SAND AND GRAVEL, SOME YELLOW	15 25 37 19	S#11, FROM 40'0" TO 42'0" RECOVERED 2"
		28 32 29 34	S#12, FROM 45'0" TO 47'0" RECOVERED 2"
	CLAY		
48'0"			

(CONTINUED ON SHEET 3)

CARR-DEE CORP.
37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone 391-4500

To HALEY & ALDRICH, INC, CAMBRIDGE, MA. 02142 Date JUNE 26, 1987 Job No 87475

Location CHARLESTOWN NAVY YARD, CHARLESTOWN, MA. Scale 1" = 3 ft.

BORING B 9 (CONTINUED)

48'0"		
VERY DENSE	80 120/2"	S# 13, FROM 50'0" TO 50'8" RECOVERED 7"
FINE TO MEDIUM		
SAND AND GRAVEL,		
	48 55 44	S# 14, FROM 55'0" TO 57'0" RECOVERED 12"
SOME YELLOW	49	
CLAY		
	35 60 57 134	S# 15, FROM 60'0" TO 62'0" RECOVERED 11"
62'0"		

NO WATER ENCOUNTERED
SIZE OF CASING NW, LENGTH 8'6"
DRILLER: K. KNOX, INSPECTOR: P. RICHARDS
DATE STARTED & COMPLETED: 6-9-87, 6-10-87

All samples have been visually classified by DRILLER Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in right hand column indicate number of blows required to drive two-inch split sampler 6 inches using 140 lb. weight falling 30 inches ±. Figures in column to left (if noted) indicate number of blows to drive casing one foot, using ? " weight falling 24 inches ±

CARR-DEE CORP.
37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone 391-4500

To HALEY & ALDRICH, INC. CAMBRIDGE, MA. 02142 Date JUNE 26, 1987 Job No 87475

Location CHARLESTOWN NAVY YARD, CHARLESTOWN, MA. Scale 1" = 3 ft.

BORING B10

GROUND SURFACE

0'6"	CONCRETE		
	FILL	4 7 10 9	S#1, FROM 0'6" TO 2'6" RECOVERED 8"
	SAND, GRAVEL, BRICK,	15 32 12 8	S#2, FROM 2'6" TO 4'6" RECOVERED 12"
	CINDERS	3 3 6 9	S#3, FROM 4'6" TO 6'6" RECOVERED 11"
		10 11	S#4, FROM 6'6" TO 7'6" RECOVERED 7"
7'6"		15 18	S#4A, FROM 7'6" TO 8'6" RECOVERED 6"
	VERY STIFF	9 12 16 20	S#5, FROM 10'0" TO 12'0" RECOVERED 6"
	YELLOW CLAY,	6 8 10 13	S#6, FROM 15'0" TO 17'0" RECOVERED 8"
	TRACE GRAVEL	7 7 18 20	S#7, FROM 20'0" TO 22'0" RECOVERY NOT RECORDED
24'0"			

(CONTINUED ON SHEET 2)

CARR-DEE CORP.
37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone 391-4500

To HALEY & ALDRICH, INC. CAMBRIDGE, MA. 02142 Date JUNE 26, 1987 Job No 87475

Location CHARLESTOWN NAVY YARD, CHARLESTOWN, MA. Scale 1" = 3 ft.

BORING B10 (CONTINUED)

24'0"		
VERY DENSE FINE TO MEDIUM SAND AND GRAVEL, SOME CLAY	11 15 58 24	S#8, FROM 25'0" TO 27'0" RECOVERED 14"
VERY DENSE FINE TO MEDIUM SAND AND GRAVEL, SOME CLAY	18 20 29 29	S#9, FROM 30'0" TO 32'0" RECOVERED 9"
MEDIUM DENSE FINE TO MEDIUM SAND AND GRAVEL, SOME CLAY	9 12 21 21	S#10, FROM 35'0" TO 37'0" RECOVERED 4"
DENSE FINE TO MEDIUM SAND AND GRAVEL, SOME YELLOW CLAY	16 24 18 21 19 21 26 17	S#11, FROM 40'0" TO 42'0" RECOVERED 5" S#12, FROM 45'0" TO 47'0" RECOVERED 13"
47'6"		

(CONTINUED ON SHEET 3)

CARR-DEE CORP.
37 LINDEN STREET P.O. BOX 67 MEDFORD, MA 02155-0001 Telephone 391-4500

To HALEY & ALDRICH, INC, CAMBRIDGE, MA. 02142 Date JUNE 26, 1987 Job No 87475

Location CHARLESTOWN NAVY YARD, CHARLESTOWN, MA. Scale 1" = 3 ft.

BORING B10 (CONTINUED)

47'6"

VERY DENSE	25 39 64 93	S#13, FROM 50'0" TO 52'0" RECOVERED 12"
FINE TO MEDIUM		
SAND AND GRAVEL,	11 27 35 37	S#14, FROM 55'0" TO 57'0" RECOVERED 15"
SOME YELLOW CLAY		
	25 72 100 120/3"	S#15, FROM 60'0" TO 61'9" RECOVERED 15"

61'9"

- R E F U S A L -

(120 BLOWS, S.S., 140-LB. WGT., 3" PENETRATION)

WATER LEVEL 13'0"
SIZE OF CASING NW, LENGTH 10'0"
DRILLER: K. KNOX, INSPECTOR: P. RICHARDS
DATE STARTED & COMPLETED: 6-10-87

All samples have been visually classified by DRILLER. Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in right hand column indicate number of blows required to drive two-inch split sampler 6 inches using 140 lb. weight falling 30 inches ±. Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches ±.

FORM 1

HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

TEST BORING REPORT

BORING NO. B100

PROJECT OIL & HAZARDOUS MATERIAL SITE EVALUATION PARCELS 39A & 150 CHARLESTOWN NAVY YARD
CLIENT CIGNA CONSULTING ENGINEERS
CONTRACTOR KENNEDY DRILLING

FILE NO. 635401
SHEET NO. 1 OF 1

LOCATION See Plan
ELEVATION
DATUM
START 30 Dec '87
FINISH 30 Dec '87
DRILLER K. Kennedy
H&A REP K. Dubois

ITEM	CASING	DRIVE SAMPLER	CORE BARREL
TYPE		55	
INSIDE DIAMETER (IN)		1 3/8	
HAMMER WEIGHT (LB)		140	
HAMMER FALL (IN)		30	

DRILLING EQUIPMENT & PROCEDURES
RIG TYPE Mobil Drill Truck
BIT TYPE HSA 6 in. OD
DRILL MUD None
OTHER Continous Samples

DEPTH (FT)	CASING BLOWS PER FT	SAMPLER BLOWS PER 6 IN	SAMPLE NUMBER & RECOVERY	SAMPLE DEPTH (FT)	STRATA CHANGE (FT)	VISUAL CLASSIFICATION AND REMARKS
					0.4	ASPHALT PAVEMENT
		18	S1	0.6		Dense brown coarse to medium SAND, trace fine gravel and
		26	(14)in			silt
		21		2.0		-Fill-
		11		3.0		Medium dense, green to brown SILT, little fine sand,
		18	S2			trace fine gravel, clay, brick fragments.
		19	(16)in			
5		11		5.0		-Fill-
		7				Medium dense, green to brown, clayey SILT, trace fine
		10	S2			gravel, brick fragments
		10	(14)in			-Fill-
		9		7.0	7.0	
		5				Stiff, green to brown, clayey SILT to silty CLAY
		6	S4			MARINE DEPOSIT AUGER SAMPLE AS2 TAKEN FROM 8-10 FT.
		7	(7)in			MODERATE FUEL OIL DOOR
		6		9.0		AMBIENT HNU RESDING OF 5 PPM
10						
		5		10.0		Medium stiff, green to brown, clayey SILT to silty CLAY
		3	S5			
		3	(8)in			MARINE DEPOSIT
		4		12.0		
15						Bottom of exploration 14.9 ft.
						NOTE
						Installed 2 inch Granite PPVC groundwater observation well in completed borehole. See groundwater observation well report for details.
20						
25						
30						

WATER LEVEL DATA

DATE	TIME	ELAPSED TIME (HR)	DEPTH (FT) TO: BOTTOM OF CASING	BOTTOM OF HOLE	WATER
12-30-87	0940	0	--	14.9ft	8.0 ft

SAMPLE IDENTIFICATION
O OPEN END ROD
T THIN WALL TUBE
U UNDISTURBED SAMPLE
S SPLIT SPOON

SUMMARY
OVERBURDEN (LIN FT) 14.9 ft.
ROCK CORED (LIN FT) --
SAMPLES 6

BORING NO. B100

H&A FORM 4 REV 3/84

FORM 1

HALEY & ALDRICH, INC. CAMBRIDGE, MASSACHUSETTS

TEST BORING REPORT

BORING NO. B101

PROJECT OIL & HAZARDOUS MATERIAL SITE EVALUATION PARCELS 39A & 150 CHARLESTOWN NAVY YARD
CLIENT CIGNA CONSULTING ENGINEERS
CONTRACTOR KENNEDY DRILLING

FILE NO. 635401
SHEET NO. 1 OF 1
LOCATION See Plan
ELEVATION
DATUM
START 30 Dec '87
FINISH 30 Dec '87
DRILLER K. Kennedy
H&A REP K. Dubois

ITEM	CASING	DRIVE SAMPLER	CORE BARREL
TYPE		55	
INSIDE DIAMETER (IN)		1 3/8	
HAMMER WEIGHT (LB)		140	
HAMMER FALL (IN)		30	

DRILLING EQUIPMENT & PROCEDURES
RIG TYPE Mobil Drill Truck
BIT TYPE HSA 6 in. OD
DRILL MUD None
OTHER Continous Samples

DEPTH (FT)	CASING BLOWS PER FT	SAMPLER BLOWS PER 6 IN	SAMPLE NUMBER & RECOVERY	SAMPLE DEPTH (FT)	STRATA CHANGE (FT)	VISUAL CLASSIFICATION AND REMARKS
					0.4	ASPHALT PAVEMENT
		21	S1	0.6		Very dense brown silty medium to fine SAND,
		33	(12)in			trace fine gravel, clay, cinders.
		96		2.0		
						-Fill-
					3.5	
5						
		8		5.0		Very stiff brown, silty CLAY, trace fine gravel.
		14	S2			
		17	(14)in			
		20		7.0		
						-MARINE DEPOSIT-
					10.0	
10						
		8		10.0		Dense, gray to brown, silty medium to fine SAND (mottled,
		11	S3			bonded) trace clay
		20	(14)in			
		26		12.-		-GLACIAL TILL-
		12		13.0		Dense, gray to brown medium to fine sandy SILT (bonded),
		14	S4			trace fine gravel.
		19	(18)in			
15		20		15.0		-GLACIAL TILL-
						Bottom of exploration 15.0 ft.
20						NOTE
						Installed 2 inch Granite PVC groundwater observation
						well in completed borehole. See groundwater observa-
						tion well report for Details.
25						
30						

WATER LEVEL DATA

DATE	TIME	ELAPSED TIME (HR)	DEPTH (FT) TO: BOTTOM OF CASING	BOTTOM OF HOLE	WATER
12-30-87	1130	0		15.0	8.5

SAMPLE IDENTIFICATION
O OPEN END ROD
T THIN WALL TUBE
U UNDISTURBED SAMPLE
S SPLIT SPOON

SUMMARY
OVERBURDEN (LIN FT) 15.0 FT.
ROCK CORED (LIN FT) NONE
SAMPLES 4

BORING NO. B101

H&A FORM 4 REV 3/84

FORM 1

HALEY & ALDRICH, INC. CAMBRIDGE, MASSACHUSETTS

TEST BORING REPORT

BORING NO. B102

PROJECT OIL & HAZARDOUS MATERIAL SITE EVALUATION PARCELS 39A & 150 CHARLESTOWN NAVY YARD
CLIENT CIGNA CONSULTING ENGINEERS
CONTRACTOR KENNEDY DRILLING

FILE NO. 635401
SHEET NO. 1 OF 1
LOCATION See Plan
ELEVATION
DATUM
START 30 Dec '87
FINISH 30 Dec '87
DRILLER K. Kennedy
H&A REP K. Dubois

ITEM	CASING	DRIVE SAMPLER	CORE BARREL
TYPE		SS	
INSIDE DIAMETER (IN)		1 3/8	
HAMMER WEIGHT (LB)		140	
HAMMER FALL (IN)		30	

DRILLING EQUIPMENT & PROCEDURES
RIG TYPE Mobil Drill Truck
BIT TYPE HSA 6 in. OD
DRILL MUD None
OTHER Continous Samples

DEPTH (FT)	CASING BLOWS PER FT	SAMPLER BLOWS PER 6 IN	SAMPLE NUMBER & RECOVERY	SAMPLE DEPTH (FT)	STRATA CHANGE (FT)	VISUAL CLASSIFICATION AND REMARKS
		17	S1	0.5		Dense brown, gravelly medium to fine SAND, little
		35	(12)in			asphalt, little to trace silt.
		26		2.0		-Fill-
		12		2.0		Medium dense brown coarse to fine SAND,
		7	S2			-Fill-
		10	(12)in			
		15				
5						
		2		5.0		Medium soft gray CLAY, little to trace silt,
		2	S3			trace gravel.
		3	(17)in			-Fill-
		2		7.0		FUEL OIL ODOR
		4		7.0		
		6	S4			Stiff black CLAY, trace coarse to fine sand, gravel and
		8	(12)in			brick fragments.
		5		9.0		FUEL OIL ODOR -FILL-
					9.5	
10						
		2		10.0		Medium dense dark-gray, SILT, little to trace fine sand,
		3	S5		11.0	fine gravel and clay (BONDED)
		20	(15)in			STRONG FUEL OIL ODOR
		18		12.0		MARINE DEPOSIT
		11		13.0		
		15	S6			Dense dark-gray SILT, little to trace fine sand, fine
		15	(6)in			gravel and clay, (BONDED)
15		15		15.0		-GLACIAL TILL-
						Bottom of exploration 15.0 ft.
						NOTE
						1. Installed 2 in. Granite PVC groundwater observation well, in completed borehole. See groundwater observation well report for details.
						2. Fuel oil odor encountered from 5.0 to 12.0 ft. DEPTH BELOW EXISTING GROUND SURFACE
20						3. HNU readings of soil on auger flight from 5.0 to 10.0 ft. depth ranged from 40 to 50 ppm.
25						
30						

WATER LEVEL DATA

DATE	TIME	ELAPSED TIME (HR)	DEPTH (FT) TO: BOTTOM OF CASING	BOTTOM OF HOLE	WATER
12-30-87	1500	0	--	15.0	6.2

SAMPLE IDENTIFICATION

O OPEN END ROD
T THIN WALL TUBE
U UNDISTURBED SAMPLE
S SPLIT SPOON

SUMMARY

OVERBURDEN (LIN FT) 15.0 FT.
ROCK CORED (LIN FT) NONE
SAMPLES 6

BORING NO. B102

H&A FORM 4 REV 3/84

APPENDIX B

Groundwater Observation Well Installation Reports
and
Groundwater Monitoring Reports

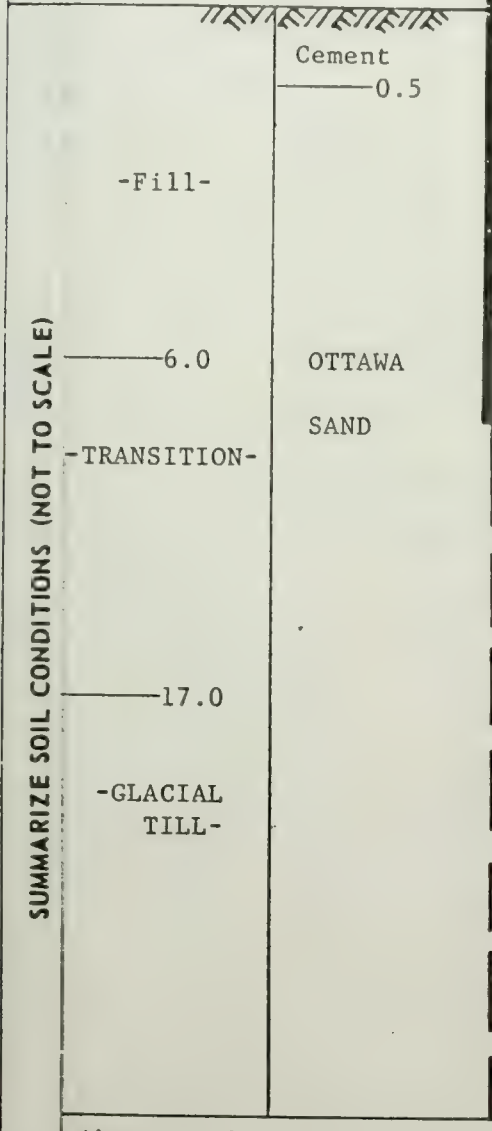
HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

GROUND WATER OBSERVATION WELL REPORT

PROJECT: PROPOSED SITE DEVELOPMENT, PARCELS 39A and 150
LOCATION: CHARLESTOWN NAVY YARD, CHARLESTOWN, MASSACHUSETTS
CLIENT: CYGNA CONSULTING ENGINEERS
CONTRACTOR: J. BOYLE
DRILLER: G. TAYLOR INSPECTOR: T. M. CORMICAN
INSTALLATION DATE 29 MAY 1987

FILE NO. 635401
WELL NO. B20W
BORING NO. B2
LOCATION See Plan
SHEET 1 OF 2

SURVEY DATUM Boston Navy Yard Datum
GROUND ELEVATION 116.3



~~ELEVATION~~ STICKUP ABOVE ~~BELOW~~ GROUND SURFACE OF ~~CASING~~ ROADWAY BOX	0.3 ft.
~~ELEVATION~~ STICKUP ABOVE ~~BELOW~~ GROUND SURFACE OF RISER PIPE.	0.2 ft.
THICKNESS OF SURFACE SEAL	0.5 ft.
TYPE OF SURFACE SEAL	Cement
[INDICATE ALL SEALS SHOWING DEPTH, THICKNESS AND TYPE]	
TYPE OF CASING	Roadway Box
INSIDE DIAMETER OF CASING	3/4 in.
~~ELEVATION~~ DEPTH OF BOTTOM OF CASING	1.7 ft.
INSIDE DIAMETER OF RISER PIPE	2.0 in.
TYPE OF BACKFILL AROUND RISER	Ottawa Sand
DIAMETER OF BOREHOLE	3.0 in.
~~ELEVATION~~ DEPTH OF BOTTOM OF RISER	5.0 ft.
TYPE OF POINT OR MANUFACTURER	Machine Slotted PVC SCN
SCREEN GAUGE OR SIZE OF OPENINGS	0.01 in.
DIAMETER OF WELLPOINT	2.0 in.
TYPE OF BACKFILL AROUND POINT	Ottawa Sand
~~ELEVATION~~ DEPTH OF BOTTOM OF POINT	15.0 ft.
~~ELEVATION~~ DEPTH OF BOTTOM OF BOREHOLE	61.4 ft.

Above scale in feet.

[FIGURES REFER TO: EL. ____ DEPTH X]

[2.0 ft. (LENGTH OF CASING L_3)] [5.0 ft. (LENGTH OF RISER PIPE (L_1)) + 10.2 ft. (LENGTH OF POINT (L_2)) = 15.2 ft. (PAY LENGTH)]

H&A FORM 59 SEP 72

HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

GROUND WATER MONITORING REPORT

OW/PE NUMBER: B2 (OW)

ELEVATION SUBTRAHEND 116.6 ft.

FILE NO. 6354-01

DATE	TIME	ELAPSED TIME	DEPTH OF WATER FROM R Box (ft)	ELEVATION OF WATER	REMARKS	READ BY
29 MAY 87	1300		3.5	113.1	Installed Today	TMC
2 JUN 87	1208	4 days	8.5	108.1		PMR
3 JUN 87	0712	5 days	8.1	108.5		PMR
9 JUN 87	0740	11 days	8.6	108.0		PMR
10 JUN 87	0814	12 days	8.7	107.9		PMR
10 JUN 87	1555	12 days	8.4	108.2		PMR
26 AUG 87	1420	89 days	9.2	107.4		BDH
14 SEPT 87	0725	108 days	6.25	110.35	Recent Heavy Rain	BDH
31 DEC 87	1345	218 days	8.9	107.7		HKD
4 JAN 88	1030	222 days	8.6	108.0	Brown, cloudy, odor-less, no visible product	HKD

H&A JAN. 79 35

HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

GROUND WATER OBSERVATION WELL REPORT

PROJECT: PROPOSED SITE DEVELOPMENT, PARCELS 39A and 150
LOCATION: CHARLESTOWN NAVY YARD, CHARLESTOWN, MASSACHUSETTS
CLIENT: CYGNA CONSULTING ENGINEERS
CONTRACTOR: J. BOYLE
DRILLER: RICHARD JONES INSPECTOR: P. RICHARDS
INSTALLATION DATE

FILE NO. 635401
WELL NO. B4A-OW
BORING NO. B4A
LOCATION See Plan
SHEET 1 OF 2

SURVEY DATUM Boston Navy Yard Datum
GROUND ELEVATION 116.1

SUMMARIZE SOIL CONDITIONS (NOT TO SCALE)

Dense C-M Sand, little gravel
Cement —0.25
Borehole Cuttings —2.0
Bentonite —3.0
Fill
Ottawa Sand
Possible in-situ organics —13.0
By driller olive CLAY, trace gravel, fine sand



~~ELEVATION~~ STICKUP ABOVE BELOW GROUND SURFACE OF CASING OR ROADWAY BOX	0.0 ft.
~~ELEVATION~~ STICKUP ~~ABOVE~~ BELOW GROUND SURFACE OF RISER PIPE.	0.05 ft.
THICKNESS OF SURFACE SEAL	0.25 ft.
TYPE OF SURFACE SEAL	Cement
[INDICATE ALL SEALS SHOWING DEPTH, THICKNESS AND TYPE]	
TYPE OF CASING	Roadway Box
INSIDE DIAMETER OF CASING	3.0 in.
~~ELEVATION~~ DEPTH OF BOTTOM OF CASING	2.0 ft.
INSIDE DIAMETER OF RISER PIPE	2.0 in.
TYPE OF BACKFILL AROUND RISER	Ottawa Sand
DIAMETER OF BOREHOLE	6.0 in.
~~ELEVATION~~ DEPTH OF BOTTOM OF RISER	5.0 ft.
TYPE OF POINT OR MANUFACTURER	PVC
SCREEN GAUGE OR SIZE OF OPENINGS	0.01 in.
DIAMETER OF WELLPOINT	2.0 in.
TYPE OF BACKFILL AROUND POINT	Ottawa Sand
~~ELEVATION~~ DEPTH OF BOTTOM OF POINT	15 ft.
~~ELEVATION~~ DEPTH OF BOTTOM OF BOREHOLE	15 ft.

Above scale in feet

[FIGURES REFER TO: EL. ____ DEPTH X]

[2.0 ft. / LENGTH OF CASING L_3] [5.0 ft. / LENGTH OF RISER PIPE (L_1) + 10.0 ft. / LENGTH OF POINT (L_2) = 15.0 ft. / PAY LENGTH]

H&A FORM SEP 72 59

HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

GROUND WATER MONITORING REPORT

OW/PE NUMBER: B4A-OW

ELEVATION SUBTRAHEND 116.1

FILE NO. 6354-01

DATE	TIME	ELAPSED TIME	DEPTH OF WATER FROM G.S. (ft.)	ELEVATION OF WATER	REMARKS	READ BY
2 JUN 87	1215		5.9	110.2		PMR
3 JUN 87	0703	1 day	6.0	110.1		PMR
9 JUN 87	0750	7 days	6.4	109.7		PMR
10 JUN 87	0819	8 days	6.3	109.8		PMR
10 JUN 87	1603	8 days	6.3	109.8		PMR
26 AUG 87	1425	85 days	7.3	108.8		BDH
14 SEPT 87	0750	104 days	5.75	110.35	Recent Heavy Rain	BDH
31 DEC 87	1350	214 days	7.4	108.7		HKD
4 JAN 87	1037	218 days	7.3	108.8	Gray-brown, opaque, odorless, no visible product	HKD

H&A FORM JAN. 70 59A

HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

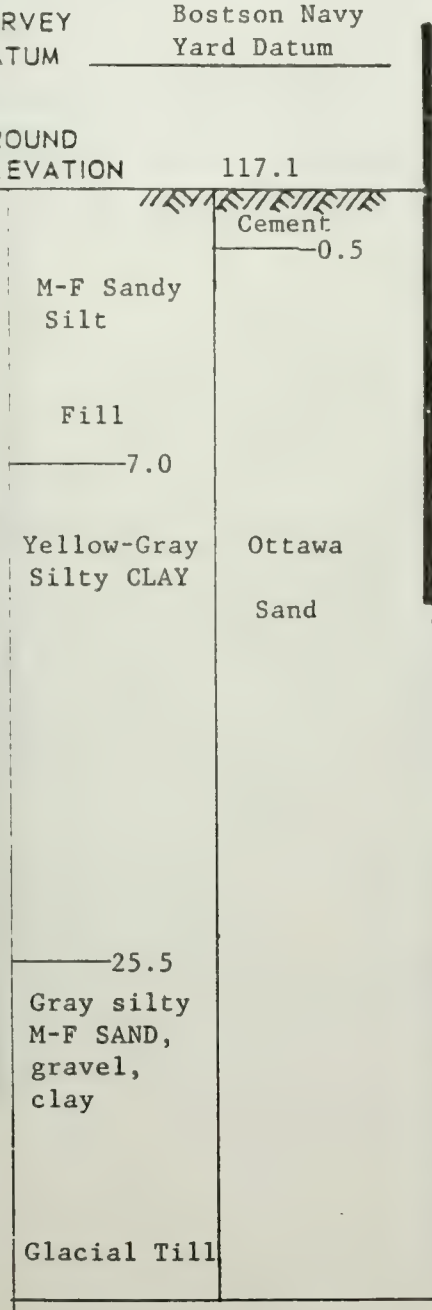
GROUND WATER OBSERVATION WELL REPORT

PROJECT: PROPOSED SITE DEVELOPMENT, PARCELS 39A and 150
LOCATION: CHARLESTOWN NAVY YARD, CHARLESTOWN, MASSACHUSETTS
CLIENT: CYGNA CONSULTING ENGINEERS
CONTRACTOR: J. BOYLE
DRILLER: _____ INSPECTOR: R. VARNUM
INSTALLATION DATE _____

FILE NO. 635401
WELL NO. B6(OW)
BORING NO. B6
LOCATION See Plan
SHEET 1 OF 2

SURVEY DATUM: Bostson Navy Yard Datum
GROUND ELEVATION: 117.1

SUMMARIZE SOIL CONDITIONS (NOT TO SCALE)



Above scale in feet.

~~ELEVATION~~ STICKUP ABOVE BELOW GROUND SURFACE OF ~~CASING~~ ROADWAY BOX	0.0 ft.
~~ELEVATION~~ STICKUP ~~ABOVE~~ BELOW GROUND SURFACE OF RISER PIPE.	0.2 ft.
THICKNESS OF SURFACE SEAL	
TYPE OF SURFACE SEAL [INDICATE ALL SEALS SHOWING DEPTH, THICKNESS AND TYPE]	Cement
TYPE OF CASING	Roadway Box
INSIDE DIAMETER OF CASING	3.0 in.
~~ELEVATION~~ DEPTH OF BOTTOM OF CASING	2.0 ft.
INSIDE DIAMETER OF RISER PIPE	2.0 in.
TYPE OF BACKFILL AROUND RISER	Ottawa Sand
DIAMETER OF BOREHOLE	6.0 in.
~~ELEVATION~~ DEPTH OF BOTTOM OF RISER	19.5 ft.
TYPE OF POINT OR MANUFACTURER	PVC
SCREEN GAUGE OR SIZE OF OPENINGS	0.01 in.
DIAMETER OF WELLPOINT	2.0 in.
TYPE OF BACKFILL AROUND POINT	Ottawa Sand
~~ELEVATION~~ DEPTH OF BOTTOM OF POINT	34.5
~~ELEVATION~~ DEPTH OF BOTTOM OF BOREHOLE	60.0 ft.

[FIGURES REFER TO: EL. ____ DEPTH X]

[2.0 ft. / LENGTH OF CASING L_3] [_____ / LENGTH OF RISER PIPE (L_1) + _____ / LENGTH OF POINT (L_2)] = [34.5' / PAY LENGTH]

H&A FORM SEP 72 59

HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

GROUND WATER MONITORING REPORT

OW/PZ NUMBER: B6(OW)

ELEVATION SUBTRAHEND 117.1

FILE NO. 6354-01

DATE	TIME	ELAPSED TIME	DEPTH OF WATER FROM TOC (ft.)	ELEVATION OF WATER	REMARKS	READ BY
3 JUN 87	0707		8.4	108.7		PMR
10 JUN 87	1550	7 days	8.4	108.7		PMR
26 AUG 87	1430	84 days	8.5	108.6		BDH
14 SEPT 87	0755	103 days	7.85	109.25	Recent Heavy Rain	BDH
31 DEC 87	1400	124 days	8.7	108.4		HKD
4 JAN 88	1037	128 days	8.5	108.6	Colorless, slightly cloudy, odorless, no visible product	HKD

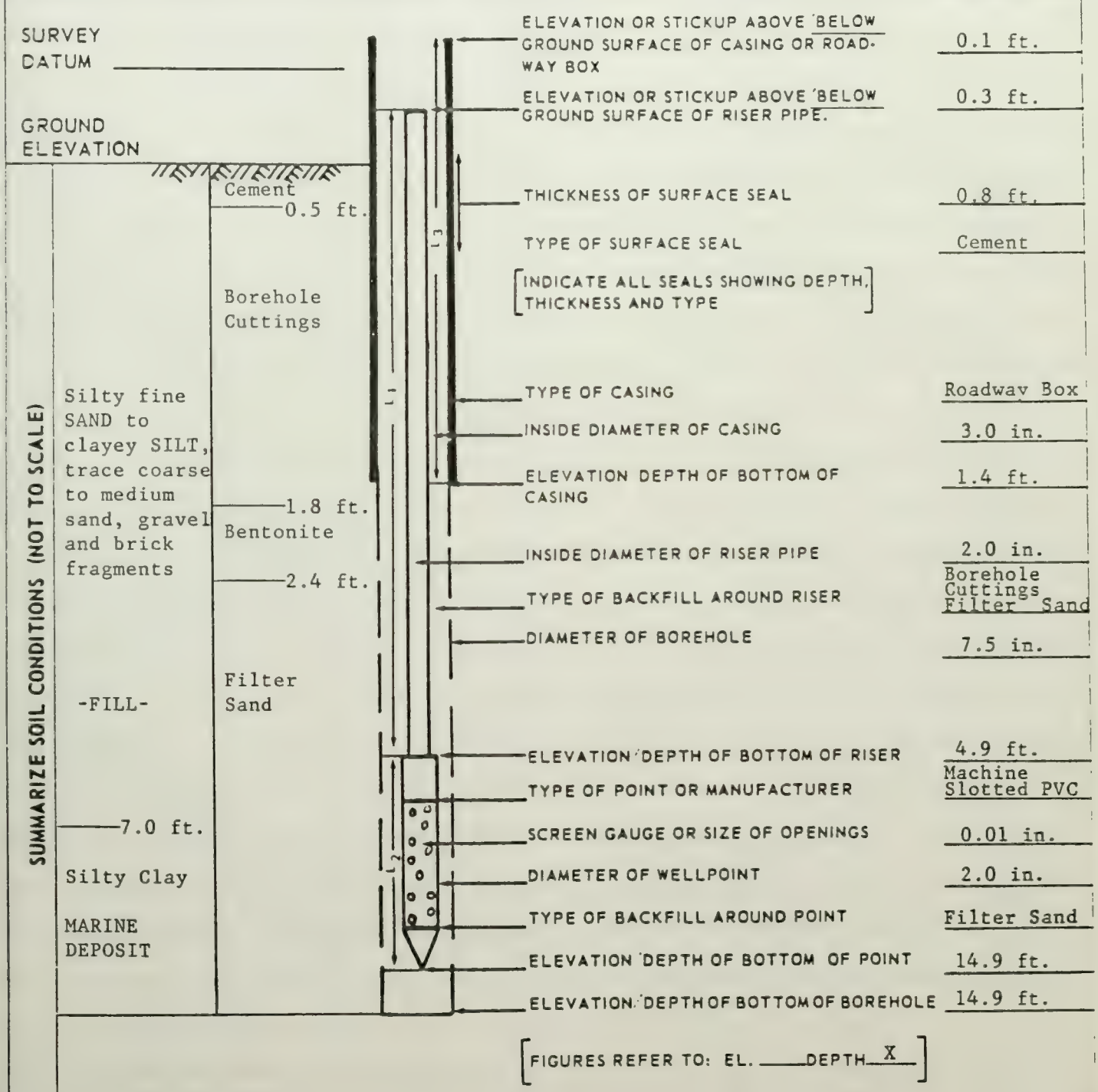
H&A JAN. 70 594

HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

GROUND WATER OBSERVATION WELL REPORT

PROJECT: OIL AND HAZARDOUS MATERIAL SITE EVALUATION
LOCATION: PARCELS 39A AND 150, CHARLESTOWN NAVY YARD
CLIENT: CYGNA CONSULTING ENGINEERS
CONTRACTOR: KENNEDY DRILLING
DRILLER: K. KENNEDY INSPECTOR: K. DuBOIS
INSTALLATION DATE 30 DECEMBER 1987

FILE NO. 6354-01
WELL NO. B100-OW
BORING NO. B100
LOCATION See Plan
SHEET 1 OF 2



[1.4 ft. / LENGTH OF CASING L_3] [4.6 ft. / LENGTH OF RISER PIPE (L_1)] + [10.0 ft. / LENGTH OF POINT (L_2)] = [14.6 ft. / PAY LENGTH]

H&A FORM SEP 72 59

HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

GROUND WATER MONITORING REPORT

OW/PE NUMBER: B100(OW)

ELEVATION SUBTRAHEND Approx. 17.6

FILE NO. 6354-01

PAGE NO. 2 of 2

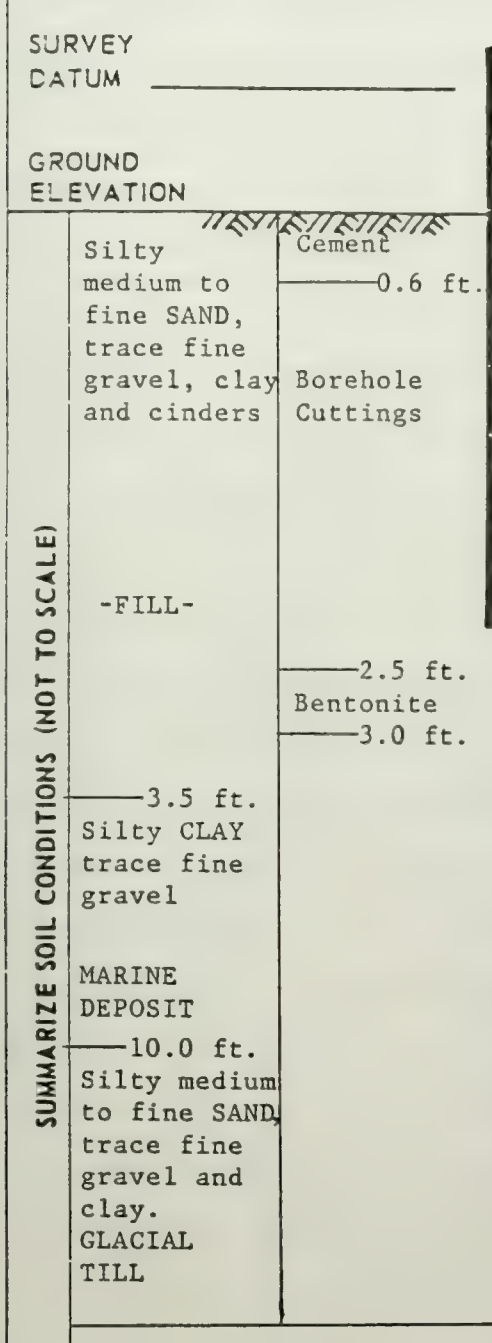
DATE	TIME	ELAPSED TIME	DEPTH OF WATER FROM R Box (ft)	ELEVATION OF WATER	REMARKS	READ BY
31 DEC 87	1355	6 hrs	8.3	Approx. 109.3		HKD
4 JAN 88	1022	18 hrs	8.0	Approx. 109.6	Colorless, slightly cloudy, slight odor, no visible product	HKD

HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

GROUND WATER OBSERVATION WELL REPORT

PROJECT: OIL AND HAZARDOUS MATERIAL SITE EVALUATION
LOCATION: PARCELS 39A AND 150, CHARLESTOWN NAVY YARD
CLIENT: CYGNA CONSULTING ENGINEERS
CONTRACTOR: KENNEDY DRILLING
DRILLER: K. KENNEDY INSPECTOR: K. DuBOIS
INSTALLATION DATE 30 DECEMBER 1987

FILE NO. 6354-01
WELL NO. B101-OW
BORING NO. B101
LOCATION See Plan
SHEET 1 OF 2



ELEVATION OR STICKUP ABOVE 'BELOW GROUND SURFACE OF CASING OR ROADWAY BOX	0.0 ft.
ELEVATION OR STICKUP ABOVE 'BELOW GROUND SURFACE OF RISER PIPE.	0.3 ft.
THICKNESS OF SURFACE SEAL	0.6 ft.
TYPE OF SURFACE SEAL	Cement
[INDICATE ALL SEALS SHOWING DEPTH, THICKNESS AND TYPE]	
TYPE OF CASING	Roadway Box
INSIDE DIAMETER OF CASING	3.0 in.
ELEVATION DEPTH OF BOTTOM OF CASING	2.0 ft.
INSIDE DIAMETER OF RISER PIPE	2.0 in.
TYPE OF BACKFILL AROUND RISER	Borehole Cuttings Filter Sand
DIAMETER OF BOREHOLE	7.5 in.
ELEVATION 'DEPTH OF BOTTOM OF RISER	4.6 ft.
TYPE OF POINT OR MANUFACTURER	Machine Slotted PVC
SCREEN GAUGE OR SIZE OF OPENINGS	0.01 in.
DIAMETER OF WELLPOINT	2.0 in.
TYPE OF BACKFILL AROUND POINT	Filter Sand
ELEVATION 'DEPTH OF BOTTOM OF POINT	14.6 ft.
ELEVATION 'DEPTH OF BOTTOM OF BOREHOLE	15.0 ft.

[FIGURES REFER TO: EL. ____ DEPTH X]

[2.0 ft. / LENGTH OF CASING L_3] [4.7 ft. / LENGTH OF RISER PIPE (L_1)] + [10.0 ft. / LENGTH OF POINT (L_2)] = 14.7 ft PAY LENGTH

H&A FORM SEP 72 59

HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

GROUND WATER MONITORING REPORT

OW-PZ NUMBER: B101(OW)

ELEVATION SUBTRAHEND Approx. 118.3

FILE NO. 6354-01
PAGE NO. 2 of 2

DATE	TIME	ELAPSED TIME	DEPTH OF WATER FROM R Box (ft)	ELEVATION OF WATER	REMARKS	READ BY
31 DEC 87	1350	4 hrs	10.3	Approx. 108.0		HKD
4 JAN 88	1037	24 hrs	10.1	Approx. 108.2	Colorless, slightly cloudy, odorless, no visible product	HKD

HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

GROUND WATER OBSERVATION WELL REPORT

PROJECT: OIL AND HAZARDOUS MATERIAL SITE EVALUATION
LOCATION: PARCELS 39A AND 150, CHARLESTOWN NAVY YARD
CLIENT: CYGNA CONSULTING ENGINEERS
CONTRACTOR: KENNEDY DRILLING
DRILLER: K. KENNEDY INSPECTOR: K. DuBOIS
INSTALLATION DATE 30 DECEMBER 1987

FILE NO. 6354-01
WELL NO. B102-OW
BORING NO. B102
LOCATION See Plan
SHEET 1 OF 2

SURVEY DATUM _____

GROUND ELEVATION

SUMMARIZE SOIL CONDITIONS (NOT TO SCALE)

CLAY, little to trace medium to fine sand, fine gravel, and silt.
0.8 ft.
Borehole Cuttings
FILL
2.2 ft.
Bentonite
3.0 ft.
9.5 ft.
Silt, little to trace fine sand, fine gravel and clay. MARINE DEPOSIT
11.0 ft.
Silt, little to trace fine sand, gravel and clay GLACIAL TILL



ELEVATION OR STICKUP ABOVE ~~XXXXX~~ GROUND SURFACE OF CASING OR ROADWAY BOX	0.4 ft.
ELEVATION OR STICKUP ABOVE ~~XXXXX~~ GROUND SURFACE OF RISER PIPE.	0.1 ft.
THICKNESS OF SURFACE SEAL	0.8 ft.
TYPE OF SURFACE SEAL	Cement
[INDICATE ALL SEALS SHOWING DEPTH, THICKNESS AND TYPE]	
TYPE OF CASING	Roadway Box
INSIDE DIAMETER OF CASING	3.0 in.
ELEVATION DEPTH OF BOTTOM OF CASING	1.6 ft.
INSIDE DIAMETER OF RISER PIPE	2.0 in.
TYPE OF BACKFILL AROUND RISER	Borehole Cuttings Filter Sand
DIAMETER OF BOREHOLE	7.5 in.
ELEVATION/DEPTH OF BOTTOM OF RISER	5.0 ft.
TYPE OF POINT OR MANUFACTURER	Machine Slotted PVC
SCREEN GAUGE OR SIZE OF OPENINGS	0.01 in.
DIAMETER OF WELLPOINT	2.0 in.
TYPE OF BACKFILL AROUND POINT	Filter Sand
ELEVATION/DEPTH OF BOTTOM OF POINT	15.0 ft.
ELEVATION/DEPTH OF BOTTOM OF BOREHOLE	15.0 ft.

[FIGURES REFER TO: EL. ____ DEPTH X]

[2.0 ft. / LENGTH OF CASING L_3] [5.0 ft. / LENGTH OF RISER PIPE (L_1) + 10.0 ft. / LENGTH OF POINT (L_2) = 15.0 ft. / PAY LENGTH]

H&A FORM SEP 72 59

HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

GROUND WATER MONITORING REPORT

OW/PZ NUMBER: B102(OW)

ELEVATION SUBTRAHEND Approx. 117

FILE NO. 6354-01

DATE	TIME	ELAPSED TIME	DEPTH OF WATER FROM R Box (ft)	ELEVATION OF WATER	REMARKS	READ BY
31 DEC 87	1340	1.0 hr	3.9	Approx. 113.1		HKD
4 JAN 88	1033	72 hrs	3.8	Approx. 113.2	Colorless, slightly cloudy, slight odor, no visible product	HKD

BRIGGS

TOWN Charlestown
PROJECT NAME Navy Yard Building # 39
PROJECT NO. 7124A1

SHEET 1 OF 1
LOCATION
HOLE NO. TB-3
LINE & STA.
OFFSET

GROUNDWATER OBSERVATIONS
At 9.5 ft. after 0 Hours
At ____ ft. after ____ Hours

	CASING	SAMPLER	CORE BAR.
Type	NW	SS	
Size I.D.	3"	1 3/8	
Hammer Wt.	300	140	BIT
Hammer Fall	24"	30"	

SURFACE ELEV.
DATE START: 1/3/87
DATE FINISH 1/3/87
BORING FOREMAN W. Souza
INSPECTOR None

LOCATION OF BORING:

Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	To 6-12	12-18	18-24	Strata Change Depth Elev.	Field Identification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
	0-2	SS	3	1	1	6		Moist-loose sand & gravel fill with brick and some silt.	1	24	12
	2-4	SS	12	7	5	4	5.0'		2	24	9
	5-7	SS	14	11	9	3		Fill - stiff clay and sand and gravel	3	24	10
	10-12	SS	2	2	5	6	9.5'	Hard yellow clay	4	24	20
	20-22	SS	5	6	9	10		Stiff yellow clay	6	24	22
							22'	End of Boring at 22'			

BLOW COUNTS FOR CLAY
< 2 Very Soft
2-4 Soft
5-8 Medium
9-15 Stiff
16-30 Very Stiff
> 30 Hard

BLOW COUNTS FOR GRANULAR MATERIAL
< 4 Very Loose
5-10 Loose
11-30 Medium
31-50 Dense
> 50 Very Dense

Proportion used: trace = 0 - 10% little = 10 - 20% some = 20 - 35% and = 35 - 50%

BRIGGS

TOWN: Charlestown
PROJECT NAME: Navy Yard Building 39
PROJECT NO.: 71241

SHEET 1 OF 2
LOCATION
HOLE NO.: IB-4
LINE & STA.
OFFSET

GROUNDWATER OBSERVATIONS
At 8.5 ft. after 24 Hours
At ___ ft. after ___ Hours

	CASING	SAMPLER	CORE BAR.
Type		SS	
Size I.D.	3"	1 3/8	
Hammer Wt.	24	30"	BIT
Hammer Fall			

SURFACE ELEV.
DATE START: January 10, 1987
DATE FINISH: January 12, 1987
BORING FOREMAN: W. Souza
INSPECTOR: None

LOCATION OF BORING:

Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	18-24	Strata Change Depth Elev.	Field Identification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
	0-2.0		1	2	22	43		Moist, very dense, brown fine sand and yellow clay and gravel. Trace of brick, concrete	1	24"	13"
	2-3.0		3.5	53	120/0"			Moist, very dense, brown fine to medium sand and gravel. Little inorganic silt trace of brick, concrete.	2	12	6
	5-7		14	10	12	12		Moist, very stiff yellow and gray clay. Some gravel	3	24	7
			DARK BROWN WASH				8.5'	Trace of fine sand. Probably Peat			
			GRAY WASH				9.5'				
	10-12		17	29	36	40		No recovery. Probably pushing on cobble yellow brown wash 12.5 to 15.0'	4	24	0"
	15-17		10	13	16	17		Moist, hard, yellow clay.	5	24	22
	20-22		4	5	6	8		Moist, stiff yellow and gray clay.	6	24	22

BLOW COUNTS FOR CLAY
< 2 Very Soft
2-4 Soft
5-8 Medium
9-15 Stiff
16-30 Very Stiff
> 30 Hard

BLOW COUNTS FOR GRANULAR MATERIAL
< 4 Very Loose
5-10 Loose
11-30 Medium
31-50 Dense
> 50 Very Dense

Proportion used: trace = 0 - 10% little = 10 - 20% some = 20 - 35% and = 35 - 50%

BRIGGS

TOWN - Charlestown
PROJECT NAME Navy Yard Building 39
PROJECT NO. 71241

SHEET 2 OF 2
LOCATION
HOLE NO. IB-4
LINE & STA.
OFFSET

GROUNDWATER OBSERVATIONS

At ___ ft. after ___ Hours

At ___ ft. after ___ Hours

	CASING	SAMPLER	CORE BAR.
Type			
Size I.D.			
Hammer Wt.			BIT
Hammer Fall			

SURFACE ELEV.
DATE START: January 10, 1987
DATE FINISH January 12, 1987
BORING FOREMAN W. Souza
INSPECTOR None

LOCATION OF BORING:

Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From - To 0-6	6-12	12-18	18-24	Strata Change Depth Elev.	Field Identification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
	25-27		15	22	19	15	25'	Moist, hard, gray clay. Little gravel. Trace fine sand. Appears to be till.	7	24	12
	30-32		13	17	23	32		Moist, hard gray clay. Some gravel trace fine sand.	8	24	1-
	33-35		13	24	70	40		Moist, hard gray clay. Some gravel. Little fine sand.	9	24	12
	40-42		19	16	23	21		Moist, hard gray clay. Some gravel. Trace of fine sand.	10	24	--
	45-47		17	24	28	34		Moist, hard gray clay. Some gravel, fine sand.	11	24	13
	50-52		105	55	59	48		Moist, hard gray clay. Some gravel, fine sand.	12	24	--
								Bottom of Boring at 52'			
								Install Observation Well 1 1/2" PVC 10' Riser 10" Screen 1 Curb Box			

BLOW COUNTS FOR CLAY

< 2	Very Soft	9-15	Stiff
2-4	Soft	16-30	Very Stiff
5-8	Medium	> 30	Hard

BLOW COUNTS FOR GRANULAR MATERIAL

< 4	Very Loose	31-50	Dense
5-10	Loose	> 50	Very Dense
11-30	Medium		

Proportion used: trace = 0 - 10% little = 10 - 20% some = 20 - 35% and = 35 - 50%

BRIGGS

TOWN Charlestown
PROJECT NAME Navy Yard Building 39
PROJECT NO. 71241

SHEET 1 OF 2
LOCATION
HOLE NO. TB-5
LINE & STA.
OFFSET

GROUNDWATER OBSERVATIONS
At 8.5 ft. after 24 Hours
At ____ ft. after ____ Hours

	CASING	SAMPLER	CORE BAR.
Type		SS	
Size I.D.	3"	1 3/8"	
Hammer Wt.	300	140	BIT
Hammer Fall	24"	30"	

SURFACE ELEV.
DATE START: January 13, 1987
DATE FINISH January 14, 198
BORING FOREMAN W. Souza
INSPECTOR None

LOCATION OF BORING:

Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	To 6-12	To 12-18	To 18-24	Strata Change Depth Elev.	Field Identification of Soil. Remarks (Incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec.
	0-2.0		2	4	4	3		Moist, loose, brown fine sand Little clay, inorganic silt Little fine gravel.	1	24	7"
	2-3.5		3	4	75			Wet, loose to very dense, brown fine sand. Little clay, inorganic silt. Some gravel trace of brick.	2	18"	8"
	5-7		14	13	14	10		Wet, medium dense, brown fine to coarse sand and fine to coarse gravel. trace of clay, inorgainc silt, brick.	3	24	10
							9.0' Gray Wash 10.0				
	10-12		9	21	25	33		Moist, hard, yellow clay trace of wood.	4	24	24
	15-17		9	10	15	16		Moist, hard, yellow clay	5	24	24
	20-22		6	7	12	13		Moist, very stiff, yellow clay.	6	24	24

BLOW COUNTS FOR CLAY
< 2 Very Soft
2-4 Soft
5-8 Medium
9-15 Stiff
16-30 Very Stiff
> 30 Hard

BLOW COUNTS FOR GRANULAR MATERIAL
< 4 Very Loose
5-10 Loose
11-30 Medium
31-50 Dense
> 50 Very Dense

Proportion used: trace = 0 - 10% little = 10 - 20% some = 20 - 35% and = 35 - 50%

BRIGGS

TOWN Charlestown
PROJECT NAME Navy Yard Building #39
PROJECT NO. 71241

SHEET 2 OF 2
LOCATION
HOLE NO. TB-5
LINE & STA.
OFFSET

GROUNDWATER OBSERVATIONS

At ___ ft. after ___ Hours

At ___ ft. after ___ Hours

	CASING	SAMPLER	CORE BAR.
Type			
Size I.D.			
Hammer Wt.			BIT
Hammer Fall			

SURFACE ELEV.
DATE START:
DATE FINISH
BORING FOREMAN
INSPECTOR

LOCATION OF BORING:

Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From - To 0-6	6-12	12-18	18-24	Strata Change Depth Elev.	Field Identification of Soil. Remarks (incl. color, loss of wash water, seams in rock, etc.)	SAMPLE No.	Pen	Rec
	25-27		3	5	7	8		Moist, stiff, gray clay spoon tip contained clay;, trace of gravel	7	24	24
							27.5				
	30-31		51	110				Moist, very dense, gray fine sand and clay. Some gravel appears to be till.	8	12	7
	35-37		29	31	34	39		Moist, very dense, gray fine sand and clay. Some gravel.	9	24	12
								Bottom of Boring 37'			
								Well and Curb box installed			
								1 1/2" soild riser 30'-20' 1 1/2" well screen 20'-5' 1 1/2 Soild riser 5-0.5' Sand 35'to 5' Seal 5' to 4'			

BLOW COUNTS FOR CLAY

< 2 Very Soft
2-4 Soft
5-8 Medium
9-15 Stiff
16-30 Very Stiff
> 30 Hard

BLOW COUNTS FOR GRANULAR MATERIAL

< 4 Very Loose
5-10 Loose
11-30 Medium
31-50 Dense
> 50 Very Dense

Proportion used: trace = 0 - 10% little = 10 - 20% some = 20 - 35% and = 35 - 50%

APPENDIX B

Observation Well Installation and Monitoring Report

HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

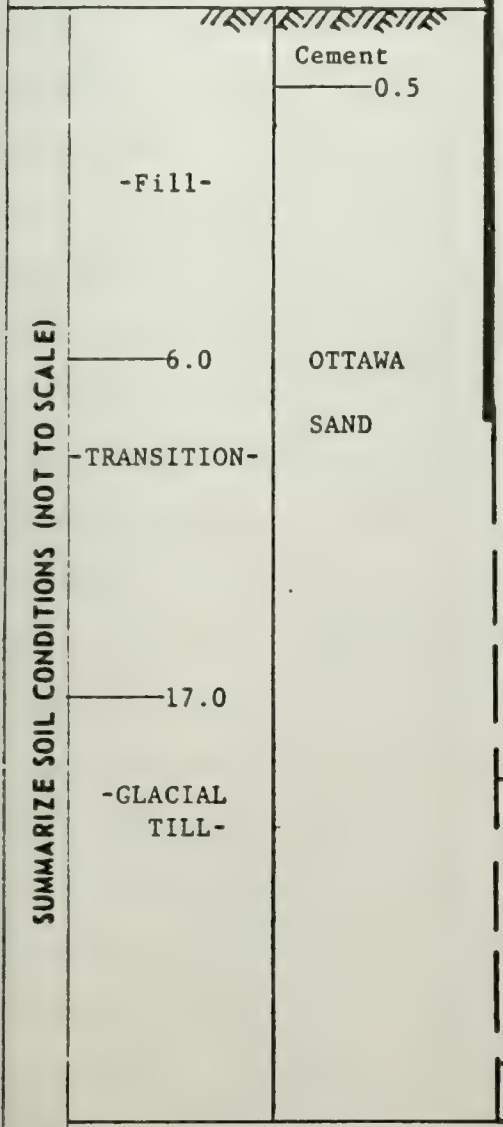
GROUND WATER OBSERVATION WELL REPORT

PROJECT: PROPOSED SITE DEVELOPMENT, PARCELS 39A and 150
LOCATION: CHARLESTOWN NAVY YARD, CHARLESTOWN, MASSACHUSETTS
CLIENT: CYGNA CONSULTING ENGINEERS
CONTRACTOR: J. BOYLE
DRILLER: G. TAYLOR INSPECTOR: T. M. CORMICAN
INSTALLATION DATE 29 MAY 1987

FILE NO. 635401
WELL NO. B20W
BORING NO. B2
LOCATION See Plan
SHEET 1 OF 2

SURVEY DATUM Boston Navy Yard Datum

GROUND ELEVATION 116.3



~~ELEVATION~~ STICKUP ABOVE ~~BELOW~~ GROUND SURFACE OF ~~CASING~~ ROADWAY BOX	0.3 ft.
~~ELEVATION~~ STICKUP ABOVE ~~BELOW~~ GROUND SURFACE OF RISER PIPE.	0.2 ft.
THICKNESS OF SURFACE SEAL	0.5 ft.
TYPE OF SURFACE SEAL	Cement
[INDICATE ALL SEALS SHOWING DEPTH, THICKNESS AND TYPE]	
TYPE OF CASING	Roadway Box
INSIDE DIAMETER OF CASING	3/4 in.
~~ELEVATION~~ DEPTH OF BOTTOM OF CASING	1.7 ft.
INSIDE DIAMETER OF RISER PIPE	2.0 in.
TYPE OF BACKFILL AROUND RISER	Ottawa Sand
DIAMETER OF BOREHOLE	3.0 in.
~~ELEVATION~~ DEPTH OF BOTTOM OF RISER	5.0 ft.
TYPE OF POINT OR MANUFACTURER	Machine Slotted PVC SCN
SCREEN GAUGE OR SIZE OF OPENINGS	0.01 in.
DIAMETER OF WELLPOINT	2.0 in.
TYPE OF BACKFILL AROUND POINT	Ottawa Sand
~~ELEVATION~~ DEPTH OF BOTTOM OF POINT	15.0 ft.
~~ELEVATION~~ DEPTH OF BOTTOM OF BOREHOLE	61.4 ft.

Above scale in feet.

[FIGURES REFER TO: EL. ____ DEPTH X]

2.0 ft.	5.0 ft.	+	10.2 ft.	=	15.2 ft.
LENGTH OF CASING L_3	LENGTH OF RISER PIPE (L_1)		LENGTH OF POINT (L_2)		PAY LENGTH

A FORM 59 SEP 72

HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

GROUND WATER MONITORING REPORT

OW/PZ NUMBER: B2 (OW)

ELEVATION SUBTRAHEND _____

FILE NO. 6354-01

DATE	TIME	ELAPSED TIME	DEPTH OF WATER FROM R Box	ELEVATION OF WATER	REMARKS	READ BY
29 MAY 87	1300		3.5	113.1	Installed Today	TMC
2 JUN 87	1208	4 days	8.5	108.1		PMR
3 JUN 87	0712	5 days	8.1	108.5		PMR
9 JUN 87	0740	11 days	8.6	108.0		PMR
10 JUN 87	0814	12 days	8.7	107.9		PMR
10 JUN 87	1555	12 days	8.4	108.2		PMR
26 AUG 87	1420	89 days	9.2	107.4		BDH
14 SEPT 87	0725	108 days	6.25	110.35	Recent Heavy Rain	BDH

HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

GROUND WATER OBSERVATION WELL REPORT

PROJECT: PROPOSED SITE DEVELOPMENT, PARCELS 39A and 150
LOCATION: CHARLESTOWN NAVY YARD, CHARLESTOWN, MASSACHUSETTS
CLIENT: CYGNA CONSULTING ENGINEERS
CONTRACTOR: J. BOYLE
DRILLER: RICHARD JONES INSPECTOR: P. RICHARDS
INSTALLATION DATE

FILE NO. 635401
WELL NO. B4A-OW
BORING NO. B4A
LOCATION See Plan
SHEET 1 OF 2

SURVEY DATUM Boston Navy Yard Datum

GROUND ELEVATION 116.1

SUMMARIZE SOIL CONDITIONS (NOT TO SCALE)

Dense C-M Sand, little gravel

Cement
0.25
Borehole Cuttings
2.0
Bentonite
3.0

Fill

Ottawa Sand

Possible in-situ organics
13.0
By driller olive CLAY, trace gravel, fine sand

Above scale in feet



~~ELEVATION~~ STICKUP ABOVE BELOW GROUND SURFACE OF CASING OR ROADWAY BOX	0.0 ft.
~~ELEVATION~~ STICKUP ~~ABOVE~~ BELOW GROUND SURFACE OF RISER PIPE.	0.05 ft.
THICKNESS OF SURFACE SEAL	0.25 ft.
TYPE OF SURFACE SEAL	Cement
[INDICATE ALL SEALS SHOWING DEPTH, THICKNESS AND TYPE]	
TYPE OF CASING	Roadway Box
INSIDE DIAMETER OF CASING	3.0 in.
~~XXXXXXXX~~ DEPTH OF BOTTOM OF CASING	2.0 ft.
INSIDE DIAMETER OF RISER PIPE	2.0 in.
TYPE OF BACKFILL AROUND RISER	Ottawa Sand
DIAMETER OF BOREHOLE	6.0 in.
~~ELEVATION~~ DEPTH OF BOTTOM OF RISER	5.0 ft.
TYPE OF POINT OR MANUFACTURER	PVC
SCREEN GAUGE OR SIZE OF OPENINGS	0.01 in.
DIAMETER OF WELLPOINT	2.0 in.
TYPE OF BACKFILL AROUND POINT	Ottawa Sand
~~ELEVATION~~ DEPTH OF BOTTOM OF POINT	15 ft.
~~ELEVATION~~ DEPTH OF BOTTOM OF BOREHOLE	15 ft.

[FIGURES REFER TO: EL. ____ DEPTH X]

[2.0 ft. / LENGTH OF CASING L_3] [5.0 ft. / LENGTH OF RISER PIPE (L_1)] + [10.0 ft. / LENGTH OF POINT (L_2)] = [15.0 ft. / PAY LENGTH]

LA FORM 59 SEP 72

HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

GROUND WATER MONITORING REPORT

OW/PZ NUMBER: B4A-OW | ELEVATION SUBTRAHEND 116.1 | FILE NO. 6354-01 | PAGE NO. 2 of 2

DATE	TIME	ELAPSED TIME	DEPTH OF WATER FROM G.S. (ft.)	ELEVATION OF WATER	REMARKS	READ BY
2 JUN 87	1215		5.9	110.2		PMR
3 JUN 87	0703	1 day	6.0	110.1		PMR
9 JUN 87	0750	7 days	6.4	109.7		PMR
10 JUN 87	0819	8 days	6.3	109.8		PMR
10 JUN 87	1603	8 days	6.3	109.8		PMR
26 AUG 87	1425	85 days	7.3	108.8		BDH
14 SEPT 87	0750	104 days	5.75	110.35	Recent Heavy Rain	BDH

HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

GROUND WATER OBSERVATION WELL REPORT

PROJECT: PROPOSED SITE DEVELOPMENT, PARCELS 39A and 150
LOCATION: CHARLESTOWN NAVY YARD, CHARLESTOWN, MASSACHUSETTS
CLIENT: CYGNA CONSULTING ENGINEERS
CONTRACTOR: J. BOYLE
DRILLER: _____ INSPECTOR: R. VARNUM
INSTALLATION DATE _____

FILE NO. 635401
WELL NO. B6(OW)
BORING NO. B6
LOCATION See Plan
SHEET 1 OF 2

SURVEY DATUM: Bostson Navy Yard Datum
GROUND ELEVATION: 117.1

SUMMARIZE SOIL CONDITIONS (NOT TO SCALE)

- Cement — 0.5
- M-F Sandy Silt
- Fill
- 7.0
- Yellow-Gray Silty CLAY
- Ottawa Sand
- 25.5
- Gray silty M-F SAND, gravel, clay
- Glacial Till

Above scale in feet.



~~ELEVATION~~ STICKUP ABOVE 'BELOW GROUND SURFACE OF ~~EXISTING~~ ROADWAY BOX	0.0 ft.
~~ELEVATION~~ STICKUP ~~ABOVE~~ 'BELOW GROUND SURFACE OF RISER PIPE.	0.2 ft.
THICKNESS OF SURFACE SEAL	
TYPE OF SURFACE SEAL	Cement
[INDICATE ALL SEALS SHOWING DEPTH, THICKNESS AND TYPE]	
TYPE OF CASING	Roadway Box
INSIDE DIAMETER OF CASING	3.0 in.
~~ELEVATION~~ DEPTH OF BOTTOM OF CASING	2.0 ft.
INSIDE DIAMETER OF RISER PIPE	2.0 in.
TYPE OF BACKFILL AROUND RISER	Ottowa Sand
DIAMETER OF BOREHOLE	6.0 in.
~~ELEVATION~~ DEPTH OF BOTTOM OF RISER	19.5 ft.
TYPE OF POINT OR MANUFACTURER	PVC
SCREEN GAUGE OR SIZE OF OPENINGS	0.01 in.
DIAMETER OF WELLPOINT	2.0 in.
TYPE OF BACKFILL AROUND POINT	Ottawa Sand
~~ELEVATION~~ DEPTH OF BOTTOM OF POINT	34.5
~~ELEVATION~~ DEPTH OF BOTTOM OF BOREHOLE	60.0 ft.

[FIGURES REFER TO: EL. ____ DEPTH X]

[2.0 ft. / LENGTH OF CASING L_3] [_____ / LENGTH OF RISER PIPE (L_1)] + [_____ / LENGTH OF POINT (L_2)] = [34.5' / PAY LENGTH]

HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

GROUND WATER MONITORING REPORT

OW/PZ NUMBER: B6(OW) | ELEVATION SUBTRAHEND 117.1 | FILE NO. 6354-01 | PAGE NO. 2 of 2

DATE	TIME	ELAPSED TIME	DEPTH OF WATER FROM TOC (ft.)	ELEVATION OF WATER	REMARKS	READ BY
3 JUN 87	0707		8.4	108.7		PMR
10 JUN 87	1550	7 days	8.4	108.7		PMR
26 AUG 87	1430	84 days	8.5	108.6		BDH
14 SEPT 87	0755	103 days	7.85	109.25	Recent Heavy Rain	BDH

APPENDIX C

Test Pit Logs

TEST PIT REPORT

Haley & Aldrich, Inc.
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

TEST PIT NO. TP1

PROJECT: OIL AND HAZARDOUS MATERIAL SITE EVALUATION
PARCELS 39A AND 150
CHARLESTOWN NAVY YARD, CHARLESTOWN, MASSACHUSETTS

CLIENT: CYGNA CONSULTING ENGINEERS

CONTRACTOR: J. MARCHESE & SONS, INC.

EQUIPMENT USED: CASE 68 OK BACKHOE W/ 3/8 CU. YD. BUCKET

FILE NO. 635401
LOCATION: See Plan
ELEVATION:
EXPLORATION DATE: 31 Dec '87
H & A REP: K. DUBOIS

SCALE IN FEET	STRATA CHANGE	SAMPLE NUMBER	SAMPLE DEPTH RANGE	DESCRIPTION OF MATERIALS (EAST / WEST)	REMARKS
			0.0	Green to brown, gravelly silt, frequent brick, concrete, cinders, occassional granite blocks.	
2				GRANITE BLOCK WALL — -FILL- — GRANITE BLOCK WALL	
4	S1	TO			
6					
	6.7		6.7	Wooden Plank floor	
	7.1		7.1	Gray to brown clayey silt (mottled).	
8		S2			
10			10.0	Bottom of exploration 10.0 ft.	
12					

GROUNDWATER

DATE	TIME*	DEPTH FT.
31 Dec 87	0810	4.2

APPROXIMATE PIT DIMENSIONS

$\frac{14.0}{(L)} \times \frac{4.0}{(W)} \times \frac{10.0}{(D)} - \frac{\quad}{2} = 560$ Cu. Ft.

BOULDERS

8" to 18" DIAM: No. - = Vol. - Cu. Ft.
Over 18" DIAM: No. - = Vol. - Cu. Ft.

SUMMARY

DEPTH 10.0 ft.
JAR SAMPLES 2
BAG SAMPLES none
GROUNDWATER 4.2 ft.
TEST PIT NO. TP1

TEST PIT REPORT

Haley & Aldrich, Inc.
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

TEST PIT NO. TP2

PROJECT: OIL AND HAZARDOUS MATERIAL SITE EVALUATION
PARCELS 39A AND 150
CHARLESTOWN NAVY YARD, CHARLESTOWN, MASSACHUSETTS

CLIENT: CYGNA CONSULTING ENGINEERS

CONTRACTOR: J. MARCHESE & SONS, INC.

EQUIPMENT USED: CASE 68 OK BACKHOE W/ 3/8 CU. YD. BUCKET

FILE NO. 635401

LOCATION: See Plan

ELEVATION:

EXPLORATION DATE: 31 Dec '87

H & A REP: K. DUBOIS

SCALE IN FEET	STRATA CHANGE	SAMPLE NUMBER	SAMPLE DEPTH RANGE	DESCRIPTION OF MATERIALS	REMARKS
			0.0	Brown fine sandy silt to silty fine sand, trace gravel, brick, wood, cinders.	
		S1	TO	-Fill-	
2					
4	4.1		4.1	Gray silty clay to clayey silt	
			5.0		
6					
		S2	TO		
8					
10					
			10.5	Bottom of exploration 10.5 ft.	
12					

GROUNDWATER

DATE	TIME*	DEPTH FT.

APPROXIMATE PIT DIMENSIONS

$\frac{15.0}{(L)} \times \frac{3.2}{(W)} \times \frac{10.5}{(D)} - \frac{\quad}{2} = 5040$ Cu. Ft.

BOULDERS

8" to 18" DIAM: No. - = Vol. - Cu. Ft.

Over 18" DIAM: No. - = Vol. - Cu. Ft.

SUMMARY

DEPTH 10.5 ft.

JAR SAMPLES 2

BAG SAMPLES -

GROUNDWATER -

TEST PIT NO. TP2

FORM 1987
MARCH 1987

TEST PIT REPORT

Haley & Aldrich, Inc.
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

TEST PIT NO. TP3

PROJECT: OIL AND HAZARDOUS MATERIAL SITE EVALUATION
PARCELS 39A AND 150
CHARLESTOWN NAVY YARD, CHARLESTOWN, MASSACHUSETTS

CLIENT: CYGNA CONSULTING ENGINEERS

CONTRACTOR: J. MARCHESE & SONS, INC.

EQUIPMENT USED: CASE 68 OK BACKHOE W/ 3/8 CU. YD. BUCKET

FILE NO. 635401
LOCATION: See Plan
ELEVATION:
EXPLORATION DATE: 31 Dec '87
H & A REP: K. DUBOIS

SCALE IN FEET	STRATA CHANGE	SAMPLE NUMBER	SAMPLE DEPTH RANGE	DESCRIPTION OF MATERIALS	REMARKS
			0.0	Brown fine sandy silt, little gravel, wood, railroad ties, trace brick. -FILL-	
2	2.0				
		S1	TO	Green to brown silty clay to clayey silt. little to trace gravel.	
4					
			5.0		Ambient HNU reading of 30 ppm, strong Fuel Oil odor.
6		S2	TO		Ambient HNU reading of 300-500 ppm, strong Fuel oil odor. Fuel oil visible as droplets on S02
8			8.0		
10					
				Bottom of exploration 11.0 ft.	
12					

GROUNDWATER

DATE	TIME*	DEPTH FT.

APPROXIMATE PIT DIMENSIONS

17.0 (L) x 4.1 (W) x 11.0 (D) - ____ / 2 = 766.1 Cu. Ft.

BOULDERS

8" to 18" DIAM: No. - = Vol. - Cu. Ft.
Over 18" DIAM: No. - = Vol. - Cu. Ft.

SUMMARY

DEPTH 11.0 ft.
JAR SAMPLES 2
BAG SAMPLES 0
GROUNDWATER -
TEST PIT NO. TP3

MARCH 1987

TEST PIT REPORT

Haley & Aldrich, Inc.
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

TEST PIT NO. TP4

PROJECT: OIL AND HAZARDOUS MATERIAL SITE EVALUATION
PARCELS 39A AND 150
CHARLESTOWN NAVY YARD, CHARLESTOWN, MASSACHUSETTS

CLIENT: CYGNA CONSULTING ENGINEERS

CONTRACTOR: J. MARCHESE & SONS, INC.

EQUIPMENT USED: CASE 68 OK BACKHOE W/ 3/8 CU. YD. BUCKET

FILE NO. 635401

LOCATION: See Plan

ELEVATION:

EXPLORATION DATE: 31 Dec '87

H & A REP: K. DUBOIS

SCALE IN FEET	STRATA CHANGE	SAMPLE NUMBER	SAMPLE DEPTH RANGE	DESCRIPTION OF MATERIALS	REMARKS
				Brown fine sandy silt, trace gravel, wood and brick	
	1.6			-FILL	
2				Refusal on concrete slab 1.6 ft.	
4					
6					
8					
10					
12					

GROUNDWATER

DATE	TIME	DEPTH FT.

APPROXIMATE PIT DIMENSIONS

$\frac{17.0}{(L)} \times \frac{11.5}{(W)} \times \frac{1.6}{(D)} - \frac{\quad}{2} = 312.8$ Cu. Ft.

BOULDERS

8" to 18" DIAM: No. - = Vol. - Cu. Ft.

SUMMARY

DEPTH 1.6 ft.
JAR SAMPLES 0
BAG SAMPLES 0
GROUNDWATER -

TEST PIT REPORT

Haley & Aldrich, Inc.
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

TEST PIT NO. TP5

PROJECT: OIL AND HAZARDOUS MATERIAL SITE EVALUATION
PARCELS 39A AND 150
CHARLESTOWN NAVY YARD, CHARLESTOWN, MASSACHUSETTS

CLIENT: CYGNA CONSULTING ENGINEERS

CONTRACTOR: J. MARCHESE & SONS, INC.

EQUIPMENT USED: CASE 68 OK BACKHOE W/ 3/8 CU. YD. BUCKET

FILE NO. 635401
LOCATION: See Plan
ELEVATION:
EXPLORATION DATE: 31 Dec '87
H & A REP: K. DUBOIS

SCALE IN FEET	STRATA CHANGE	SAMPLE NUMBER	SAMPLE DEPTH RANGE	DESCRIPTION OF MATERIALS	REMARKS
			0.0	Gray to brown silt, little fine sand, trace clay, gravel, wood, wire. -FILL-	
2		S1	TO		
4	4.0		4.0		
				Wood floor	
	4.3		4.3		
				Green to gray silty clay, trace gravel.	Peculiar brine like odor
6					
		S2	TO		
8					
10					
12			12.0		
				Bottom of exploration 12.0 Ft.	

GROUNDWATER		
DATE	TIME*	DEPTH FT.
31 Dec 87	0945	4.0

APPROXIMATE PIT DIMENSIONS

16.0 (L) × 7.0 (W) × 12.0 (D) ÷ 2 = 1344 Cu. Ft.

BOULDERS

8" to 18" DIAM: No. - = Vol. - Cu. Ft.
Over 18" DIAM: No. - = Vol. - Cu. Ft.

SUMMARY

DEPTH 12 Ft.
JAR SAMPLES 2
BAG SAMPLES 0
GROUNDWATER 4.0 Ft.

TEST PIT NO. TP5

TEST PIT REPORT

Haley & Aldrich, Inc.
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

TEST PIT NO. TP6

PROJECT: OIL AND HAZARDOUS MATERIAL SITE EVALUATION
PARCELS 39A AND 150
CHARLESTOWN NAVY YARD, CHARLESTOWN, MASSACHUSETTS

CLIENT: CYGNA CONSULTING ENGINEERS

CONTRACTOR: J. MARCHESE & SONS, INC.

EQUIPMENT USED: CASE 68 OK BACKHOE W/ 3/8 CU. YD. BUCKET

FILE NO. 635401

LOCATION: See Plan

ELEVATION:

EXPLORATION DATE: 31 Dec '87

H & A REP: K. DUBOIS

SCALE IN FEET	STRATA CHANGE	SAMPLE NUMBER	SAMPLE DEPTH RANGE	DESCRIPTION OF MATERIALS	REMARKS
		S1	0.0 TO 1.5	Brown medium to fine sand, frequent concrete slab fragments and brick -FILL-	
2				Refusal on concrete slab fragments 1.5 ft.	
4					
6					
8					
10					
12					

GROUNDWATER

DATE	TIME*	DEPTH FT.

APPROXIMATE PIT DIMENSIONS

10.0 (L) x 8.0 (W) x 1.5 (D) - ____ / 2 = 120 Cu. Ft.

BOULDERS

8" to 18" DIAM: No. - = Vol. - Cu. Ft.

SUMMARY

DEPTH 1.5 ft.
JAR SAMPLES 1
BAG SAMPLES 0
GROUNDWATER -

MARCH 1987

TEST PIT REPORT

Haley & Aldrich, Inc.
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

TEST PIT NO. TP7

PROJECT: OIL AND HAZARDOUS MATERIAL SITE EVALUATION
PARCELS 39A AND 150
CHARLESTOWN NAVY YARD, CHARLESTOWN, MASSACHUSETTS

CLIENT: CYGNA CONSULTING ENGINEERS

CONTRACTOR: J. MARCHESE & SONS, INC.

EQUIPMENT USED: CASE 68 OK BACKHOE W/ 3/8 CU. YD. BUCKET

FILE NO. 635401

LOCATION: See Plan

ELEVATION:

EXPLORATION DATE: 31 Dec '87

H & A REP: K. DUBOIS

SCALE IN FEET	STRATA CHANGE	SAMPLE NUMBER	SAMPLE DEPTH RANGE	DESCRIPTION OF MATERIALS	REMARKS
			0.0	Brown coarse to fine sandy gravel, frequent concrete slab fragments, bricks, wood, and pipe.	
2		S1	TO	-FILL-	
4			4.0	Refusal on possible foundation wall 4.0 ft.	
6					
8					
10					
12					

GROUNDWATER

DATE	TIME*	DEPTH FT.

APPROXIMATE PIT DIMENSIONS

8.0 (L) x 4.0 (W) x 4.0 (D) - ____ / 2 = 128 Cu. Ft.

BOULDERS

8" to 18" DIAM: No. - = Vol. - Cu. Ft.

SUMMARY

DEPTH 4.0 ft.
JAR SAMPLES 1
BAG SAMPLES 0
GROUNDWATER -

MARCH 1987

TEST PIT REPORT

Haley & Aldrich, Inc.
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

TEST PIT NO. TP8

PROJECT: OIL AND HAZARDOUS MATERIAL SITE EVALUATION
PARCELS 39A AND 150
CHARLESTOWN NAVY YARD, CHARLESTOWN, MASSACHUSETTS

CLIENT: CYGNA CONSULTING ENGINEERS

CONTRACTOR: J. MARCHESE & SONS, INC.

EQUIPMENT USED: CASE 68 OK BACKHOE W/ 3/8 CU. YD. BUCKET

FILE NO. 635401
LOCATION: See Plan
ELEVATION:
EXPLORATION DATE: 31 Dec '87
H & A REP: K. DUBOIS

SCALE IN FEET	STRATA CHANGE	SAMPLE NUMBER	SAMPLE DEPTH RANGE	DESCRIPTION OF MATERIALS	REMARKS
			0.0	Dark-brown silt, trace fine sand, clay, frequent concrete blocks, granite blocks, pipe, and brick.	
2		S1	TO	-FILL-	
4			5.5		
				Refusal on foundation wall 5.5 ft.	
6					
8					
10					
12					

GROUNDWATER

DATE	TIME*	DEPTH FT.

APPROXIMATE PIT DIMENSIONS

$\frac{13.0}{(L)} \times \frac{5.0}{(W)} \times \frac{5.5}{(D)} - \frac{\quad}{2} = 357.5$ Cu. Ft.

BOULDERS

8" to 18" DIAM: No. - = Vol. - Cu. Ft.
Over 18" DIAM: No. - = Vol. - Cu. Ft.

SUMMARY

DEPTH 5.5 ft.
JAR SAMPLES 1
BAG SAMPLES -
GROUNDWATER -
TEST PIT NO. TP8

MARCH 1987

APPENDIX D

Chemical Test Results

RECEIVED
JAN 27 1988
HALEY & ALDRICH, INC.

Enseco

January 22, 1988

Ms. Anne Zoeller
Haley & Aldrich, Inc.
58 Charles Street
Cambridge, MA 02141

Dear Anne:

Enclosed are the analytical results for ten soil samples we received on December 31, 1987, under Job No. 635401 (Erco Project No. 7622-6369).

If you have any questions about the data, please do not hesitate to contact me.

Sincerely,

Dallas Wait

A. Dallas Wait, Ph.D.
Vice President
Director of Program Management

ADW:kk
Encl.

205 Alewife Brook Parkway
Cambridge, Massachusetts 02138
617/661-3111 Facsimile: 617/354-5258

Enseco

PETROLEUM HYDROCARBON ANALYSIS BY IR

EPA Method 418.1

Client Name: Haley & Aldrich, Inc. (Job No. 635401)

Client ID: TP1-S1

Laboratory ID: 6369-05

Matrix: Solid Sampled: 12/30/87 Received: 12/31/87

Authorized: 12/31/87 Prepared: 01/04/88 Analyzed: 01/13/88

Parameter	Result	Units	Reporting Limit
Petroleum hydrocarbon	250	µg/g (dry wt)	40

Solid content = 87%

Reported by AN Approved by MEF

HYDROCARBON FINGERPRINTING
U.S. COAST GUARD OIL SPILL IDENTIFICATION SYSTEM
MARINE ORGANICS LABORATORY

Client Name: Haley & Aldrich, Inc. (Job No. 635401)
Matrix: Solid
Authorized: 12/31/87 Sampled: 12/30/87 Received: 12/31/87
Concentration Units: µg/g (ppm) Prepared: 01/05/88 Analyzed: 01/19/87

Enseco ID	Client ID	Total Petroleum Hydro-carbons	Reporting Limits for Individual Hydrocarbons	Reporting Limits for Total Product	% Solids
6369-07	TP3-S2	350	0.4	10	88

Qualitative Identification: This sample has GC/FID characteristics that are similar to a mixture of gasoline and highly weathered Fuel Oil No. 2.

All samples are corrected for Method Blank.
Minimum reporting limit for individual hydrocarbons = 0.2 µg/g (dry wt).
Minimum reporting limit for total products = 5.0 µg/g (dry wt).
Internal standard recovery = 119%.

Reported by mm Approved by AH

EP TOXICITY METALS

Client Name: Haley & Aldrich, Inc. (Job No. 635401)
Client ID: B100-S2
Laboratory ID: 6369-01
Matrix: Solid Sampled: 12/30/87 Received: 12/31/87
Authorized: 12/31/87 Prepared: 01/12/88 Analyzed: 01/20/88

Parameter	Result in Leachate	Units	Reporting Limit	Regulated Limit in Leachate	Analytical Method
Arsenic	ND	mg/L	0.25	5	7060/200.7
Barium	ND	mg/L	2.0	100	7080/200.7
Cadmium	ND	mg/L	0.05	1	7130/200.7
Chromium	ND	mg/L	0.2	5	7190/200.7
Lead	ND	mg/L	0.25	5	7420/200.7
Mercury	ND	mg/L	0.001	0.2	7470
Selenium	ND	mg/L	0.02	1	7740
Silver	ND	mg/L	0.025	5	7760/200.7

ND = Not detected.

Reported by CMC Approved by SDC

Enseco

EP TOXICITY METALS

Client Name: Haley & Aldrich, Inc. (Job No. 635401)

Client ID: TP1-S1

Laboratory ID: 6369-05

Matrix: Solid Sampled: 12/30/87 Received: 12/31/87

Authorized: 12/31/87 Prepared: 01/12/88 Analyzed: 01/20/88

Parameter	Result in Leachate	Units	Reporting Limit	Regulated Limit in Leachate	Analytical Method
Arsenic	ND	mg/L	0.25	5	7060/200.7
Barium	ND	mg/L	2.0	100	7080/200.7
Cadmium	ND	mg/L	0.05	1	7130/200.7
Chromium	ND	mg/L	0.2	5	7190/200.7
Lead	ND	mg/L	0.25	5	7420/200.7
Mercury	ND	mg/L	0.001	0.2	7470
Selenium	ND	mg/L	0.02	1	7740
Silver	ND	mg/L	0.025	5	7760/200.7

ND = Not detected.

Reported by JMC Approved by SDC

EP TOXICITY METALS

Client Name: Haley & Aldrich, Inc. (Job No. 635401)
Client ID: TP2-S1
Laboratory ID: 6369-03
Matrix: Solid Sampled: 12/30/87 Received: 12/31/87
Authorized: 12/31/87 Prepared: 01/12/88 Analyzed: 01/20/88

Parameter	Result in Leachate	Units	Reporting Limit	Regulated Limit in Leachate	Analytical Method
Arsenic	ND	mg/L	0.25	5	7060/200.7
Barium	ND	mg/L	2.0	100	7080/200.7
Cadmium	ND	mg/L	0.05	1	7130/200.7
Chromium	ND	mg/L	0.2	5	7190/200.7
Lead	ND	mg/L	0.25	5	7420/200.7
Mercury	ND	mg/L	0.001	0.2	7470
Selenium	ND	mg/L	0.02	1	7740
Silver	ND	mg/L	0.025	5	7760/200.7

ND = Not detected.

Reported by KL Approved by SDC

EP TOXICITY METALS

Client Name: Haley & Aldrich, Inc. (Job No. 635401)
Client ID: TP3-S1
Laboratory ID: 6369-06
Matrix: Solid Sampled: 12/30/87 Received: 12/31/87
Authorized: 12/31/87 Prepared: 01/12/88 Analyzed: 01/20/88

Parameter	Result in Leachate	Units	Reporting Limit	Regulated Limit in Leachate	Analytical Method
Arsenic	ND	mg/L	0.25	5	7060/200.7
Barium	ND	mg/L	2.0	100	7080/200.7
Cadmium	ND	mg/L	0.05	1	7130/200.7
Chromium	ND	mg/L	0.2	5	7190/200.7
Lead	ND	mg/L	0.25	5	7420/200.7
Mercury	ND	mg/L	0.001	0.2	7470
Selenium	ND	mg/L	0.02	1	7740
Silver	ND	mg/L	0.025	5	7760/200.7

ND = Not detected.

Reported by CMC Approved by SNC

Enseco

PRIORITY POLLUTANT ORGANOCHLORINE PESTICIDES/PCBs

EPA Method 8080

Client Name: Haley & Aldrich, Inc. (Job No. 635401)

Client ID: B100-S2

Laboratory ID: 6369-01

Matrix: Solid Sampled: 12/30/87 Received: 12/31/87

Authorized: 12/31/87 Prepared: 01/07/88 Analyzed: 01/20/88

Parameter	Result	Units	Reporting Limit
alpha-BHC	ND	µg/kg (dry wt)	16
beta-BHC	ND	µg/kg (dry wt)	16
delta-BHC	ND	µg/kg (dry wt)	16
gamma-BHC (Lindane)	ND	µg/kg (dry wt)	16
Heptachlor	ND	µg/kg (dry wt)	16
Aldrin	ND	µg/kg (dry wt)	16
Heptachlor epoxide	ND	µg/kg (dry wt)	16
Endosulfan I	ND	µg/kg (dry wt)	16
Dieldrin	ND	µg/kg (dry wt)	32
4,4'-DDE	ND	µg/kg (dry wt)	32
Endrin	ND	µg/kg (dry wt)	32
Endosulfan II	ND	µg/kg (dry wt)	32
4,4'-DDD	ND	µg/kg (dry wt)	32
Endosulfan sulfate	ND	µg/kg (dry wt)	32
4,4'-DDT	ND	µg/kg (dry wt)	32
Endrin aldehyde	ND	µg/kg (dry wt)	32
Methoxychlor	ND	µg/kg (dry wt)	160
Chlordane	ND	µg/kg (dry wt)	160
Toxaphene	ND	µg/kg (dry wt)	320
Aroclor-1016	ND	µg/kg (dry wt)	160
Aroclor-1221	ND	µg/kg (dry wt)	160
Aroclor-1232	ND	µg/kg (dry wt)	160
Aroclor-1242	ND	µg/kg (dry wt)	160
Aroclor-1248	ND	µg/kg (dry wt)	160
Aroclor-1254	ND	µg/kg (dry wt)	160
Aroclor-1260	ND	µg/kg (dry wt)	160

Solid content = 91%

ND = Not detected.

Reported by MEF Approved by EK

Enseco

PRIORITY POLLUTANT ORGANOCHLORINE PESTICIDES/PCBs

EPA Method 8080

Client Name: Haley & Aldrich, Inc. (Job No. 635401)
Client ID: TP1-S1
Laboratory ID: 6369-05
Matrix: Solid Sampled: 12/30/87 Received: 12/31/87
Authorized: 12/31/87 Prepared: 01/07/88 Analyzed: 01/20/88

Parameter	Result	Units	Reporting Limit
alpha-BHC	ND	µg/kg (dry wt)	16
beta-BHC	ND	µg/kg (dry wt)	16
delta-BHC	ND	µg/kg (dry wt)	16
gamma-BHC (Lindane)	ND	µg/kg (dry wt)	16
Heptachlor	ND	µg/kg (dry wt)	16
Aldrin	ND	µg/kg (dry wt)	16
Heptachlor epoxide	ND	µg/kg (dry wt)	16
Endosulfan I	ND	µg/kg (dry wt)	16
Dieldrin	ND	µg/kg (dry wt)	32
4,4'-DDE	ND	µg/kg (dry wt)	32
Endrin	ND	µg/kg (dry wt)	32
Endosulfan II	ND	µg/kg (dry wt)	32
4,4'-DDD	ND	µg/kg (dry wt)	32
Endosulfan sulfate	ND	µg/kg (dry wt)	32
4,4'-DDT	ND	µg/kg (dry wt)	32
Endrin aldehyde	ND	µg/kg (dry wt)	32
Methoxychlor	ND	µg/kg (dry wt)	160
Chlordane	ND	µg/kg (dry wt)	160
Toxaphene	ND	µg/kg (dry wt)	320
Aroclor-1016	ND	µg/kg (dry wt)	160
Aroclor-1221	ND	µg/kg (dry wt)	160
Aroclor-1232	ND	µg/kg (dry wt)	160
Aroclor-1242	ND	µg/kg (dry wt)	160
Aroclor-1248	ND	µg/kg (dry wt)	160
Aroclor-1254	ND	µg/kg (dry wt)	160
Aroclor-1260	ND	µg/kg (dry wt)	160

Solid content = 90%

ND = Not detected.

Reported by MEF **Approved by** EK

Enseco

PRIORITY POLLUTANT ORGANOCHLORINE PESTICIDES/PCBs

EPA Method 8080

Client Name: Haley & Aldrich, Inc. (Job No. 635401)

Client ID: TP2-S1

Laboratory ID: 6369-03

Matrix: Solid Sampled: 12/30/87 Received: 12/31/87

Authorized: 12/31/87 Prepared: 01/07/88 Analyzed: 01/20/88

Parameter	Result	Units	Reporting Limit
alpha-BHC	ND	µg/kg (dry wt)	16
beta-BHC	ND	µg/kg (dry wt)	16
delta-BHC	ND	µg/kg (dry wt)	16
gamma-BHC (Lindane)	ND	µg/kg (dry wt)	16
Heptachlor	ND	µg/kg (dry wt)	16
Aldrin	ND	µg/kg (dry wt)	16
Heptachlor epoxide	ND	µg/kg (dry wt)	16
Endosulfan I	ND	µg/kg (dry wt)	16
Dieldrin	ND	µg/kg (dry wt)	32
4,4'-DDE	ND	µg/kg (dry wt)	32
Endrin	ND	µg/kg (dry wt)	32
Endosulfan II	ND	µg/kg (dry wt)	32
4,4'-DDD	ND	µg/kg (dry wt)	32
Endosulfan sulfate	ND	µg/kg (dry wt)	32
4,4'-DDT	ND	µg/kg (dry wt)	32
Endrin aldehyde	ND	µg/kg (dry wt)	32
Methoxychlor	ND	µg/kg (dry wt)	160
Chlordane	ND	µg/kg (dry wt)	160
Toxaphene	ND	µg/kg (dry wt)	320
Aroclor-1016	ND	µg/kg (dry wt)	160
Aroclor-1221	ND	µg/kg (dry wt)	160
Aroclor-1232	ND	µg/kg (dry wt)	160
Aroclor-1242	ND	µg/kg (dry wt)	160
Aroclor-1248	ND	µg/kg (dry wt)	160
Aroclor-1254	ND	µg/kg (dry wt)	160
Aroclor-1260	ND	µg/kg (dry wt)	160

Solid content = 84%

ND = Not detected.

Reported by MEF Approved by EK

Enseco

PRIORITY POLLUTANT ORGANOCHLORINE PESTICIDES/PCBs

EPA Method 8080

Client Name: Haley & Aldrich, Inc. (Job No. 635401)

Client ID: TP3-S1

Laboratory ID: 6369-06

Matrix: Solid Sampled: 12/30/87 Received: 12/31/87

Authorized: 12/31/87 Prepared: 01/07/88 Analyzed: 01/20/88

Parameter	Result	Units	Reporting Limit
alpha-BHC	ND	µg/kg (dry wt)	320
beta-BHC	ND	µg/kg (dry wt)	320
delta-BHC	ND	µg/kg (dry wt)	320
gamma-BHC (Lindane)	ND	µg/kg (dry wt)	320
Heptachlor	ND	µg/kg (dry wt)	320
Aldrin	ND	µg/kg (dry wt)	320
Heptachlor epoxide	ND	µg/kg (dry wt)	320
Endosulfan I	ND	µg/kg (dry wt)	320
Dieldrin	ND	µg/kg (dry wt)	640
4,4'-DDE	ND	µg/kg (dry wt)	640
Endrin	ND	µg/kg (dry wt)	640
Endosulfan II	ND	µg/kg (dry wt)	640
4,4'-DDD	ND	µg/kg (dry wt)	640
Endosulfan sulfate	ND	µg/kg (dry wt)	640
4,4'-DDT	ND	µg/kg (dry wt)	640
Endrin aldehyde	ND	µg/kg (dry wt)	640
Methoxychlor	ND	µg/kg (dry wt)	3,200
Chlordane	ND	µg/kg (dry wt)	3,200
Toxaphene	ND	µg/kg (dry wt)	6,400
Aroclor-1016	ND	µg/kg (dry wt)	3,200
Aroclor-1221	ND	µg/kg (dry wt)	3,200
Aroclor-1232	ND	µg/kg (dry wt)	3,200
Aroclor-1242	ND	µg/kg (dry wt)	3,200
Aroclor-1248	ND	µg/kg (dry wt)	3,200
Aroclor-1254	ND	µg/kg (dry wt)	3,200
Aroclor-1260	ND	µg/kg (dry wt)	3,200

Solid content = 88%

ND = Not detected.

Reported by MEF Approved by EK

Enseco

CLIENT: Haley & Aldrich, Inc. (Job No. 655401)
SAMPLE RECEIVED: 12/31/87
ANALYSIS COMPLETED: 01/25/88
RESULTS IN: µg/g (ppm) dry wt*
REPORTED BY: YLK MO
CHECKED BY: EO

INORGANIC ANALYSIS

SOLID

- Data Report -

Erco ID	Client ID	Chloride	Solids, Total (%)	pH†
6369-04	TP2-S2	2,220	86.0	7.4
6369-09	B101-S3	682	90.5	7.6
6369-10	TP5-S2	<62	80.8	6.4
Erco Blank		<5.0**	NA	5.6
Laboratory Control Spike		105%	NA	NA
Laboratory Control Spike Dup.		99%	NA	NA
Method Used:		325.2	160.3	9045

If customer has any questions regarding analysis, refer to sample in question by its Erco ID#.

*Unless otherwise indicated.

†Soil pH measured in water.

**Results in mg/L.

NA = Not applicable.

Enseco

RECEIVED
JAN 2 1988
HALEY & ALDRICH, INC.

January 25, 1988

Mr. Keith Dubois
Haley & Aldrich, Inc.
Pine Tree Place 360-8
Route 101
Bedford, NH 03102

Dear Keith:

Enclosed are the analytical results for five water samples we received on January 4, 1988, under Job No. 635401 (Erco Project No. 7622-6374).

If you have any questions about the data, please do not hesitate to contact me.

Sincerely,

A. Dallas Wait, Ph.D.
Vice President
Director of Program Management

ADW:kk
Encl.

205 Alewife Brook Parkway
Cambridge, Massachusetts 02138
617/661-3111 Facsimile: 617/354-5258

HAZARDOUS SUBSTANCE LIST (HSL)
SEMIVOLATILE ORGANICS

EPA Method 625/HSL List

Client Name: Haley & Aldrich, Inc. (Job No. 635401)
Client ID: B4-OW
Laboratory ID: 6374-05
Matrix: Aqueous Sampled: 01/04/88 Received: 01/04/88
Authorized: 01/04/88 Prepared: 01/05/88 Analyzed: 01/18/88

Parameter	Result	Units	Reporting Limit
Phenol	ND	µg/L	20
bis(2-Chloroethyl)ether	ND	µg/L	20
2-Chlorophenol	ND	µg/L	20
1,3-Dichlorobenzene	ND	µg/L	20
1,4-Dichlorobenzene	ND	µg/L	20
Benzyl alcohol	ND	µg/L	20
1,2-Dichlorobenzene	ND	µg/L	20
2-Methylphenol	ND	µg/L	20
bis(2-Chloroisopropyl)ether	ND	µg/L	20
4-Methylphenol	ND	µg/L	20
N-Nitroso-di-n-propylamine	ND	µg/L	20
Hexachloroethane	ND	µg/L	20
Nitrobenzene	ND	µg/L	20
Isophorone	ND	µg/L	20
2-Nitrophenol	ND	µg/L	20
2,4-Dimethylphenol	ND	µg/L	20
Benzoic acid	ND	µg/L	100
bis(2-Chloroethoxy)methane	ND	µg/L	20
2,4-Dichlorophenol	ND	µg/L	20
1,2,4-Trichlorobenzene	ND	µg/L	20
Naphthalene	ND	µg/L	20
4-Chloroaniline	ND	µg/L	20
Hexachlorobutadiene	ND	µg/L	20
4-Chloro-3-methylphenol	ND	µg/L	20
2-Methylnaphthalene	ND	µg/L	20
Hexachlorocyclopentadiene	ND	µg/L	20
2,4,6-Trichlorophenol	ND	µg/L	20
2,4,5-Trichlorophenol	ND	µg/L	100
2-Chloronaphthalene	ND	µg/L	20
2-Nitroaniline	ND	µg/L	100
Dimethyl phthalate	ND	µg/L	20
Acenaphthylene	ND	µg/L	20
3-Nitroaniline	ND	µg/L	100
Acenaphthene	ND	µg/L	20

(continued on following page)

ND = Not detected.

Enseco

HAZARDOUS SUBSTANCE LIST (HSL)
SEMIVOLATILE ORGANICS (CONT.)

EPA Method 625/HSL List

Client Name: Haley & Aldrich, Inc. (Job No. 635401)
Client ID: B4-OW
Laboratory ID: 6374-05
Matrix: Aqueous Sampled: 01/04/88 Received: 01/04/88
Authorized: 01/04/88 Prepared: 01/05/88 Analyzed: 01/18/88

Parameter	Result	Units	Reporting Limit
2,4-Dinitrophenol	ND	µg/L	100
4-Nitrophenol	ND	µg/L	100
Dibenzofuran	ND	µg/L	20
2,4-Dinitrotoluene	ND	µg/L	20
2,6-Dinitrotoluene	ND	µg/L	20
Diethyl phthalate	ND	µg/L	20
4-Chlorophenyl phenyl ether	ND	µg/L	20
Fluorene	ND	µg/L	20
4-Nitroaniline	ND	µg/L	100
4,6-Dinitro-2-methylphenol	ND	µg/L	100
N-Nitrosodiphenylamine	ND	µg/L	20
4-Bromophenyl phenyl ether	ND	µg/L	20
Hexachlorobenzene	ND	µg/L	20
Pentachlorophenol	ND	µg/L	100
Phenanthrene	ND	µg/L	20
Anthracene	ND	µg/L	20
Di-n-butyl phthalate	ND	µg/L	20
Fluoranthene	ND	µg/L	20
Pyrene	ND	µg/L	20
Butyl benzyl phthalate	ND	µg/L	20
3,3'-Dichlorobenzidine	ND	µg/L	40
Benzo(a)anthracene	ND	µg/L	20
bis(2-Ethylhexyl)phthalate	ND	µg/L	20
Chrysene	ND	µg/L	20
Di-n-octyl phthalate	ND	µg/L	20
Benzo(b)fluoranthene	ND	µg/L	20
Benzo(k)fluoranthene	ND	µg/L	20
Benzo(a)pyrene	ND	µg/L	20
Indeno(1,2,3-c,d)pyrene	ND	µg/L	20
Dibenzo(a,h)anthracene	ND	µg/L	20
Benzo(g,h,i)perylene	ND	µg/L	20

ND = Not detected.

Reported by MR Approved by WL



HAZARDOUS SUBSTANCE LIST (HSL)
SEMIVOLATILE ORGANICS

EPA Method 625/HSL List

Client Name: Haley & Aldrich, Inc. (Job No. 635401)
Client ID: B100-OW
Laboratory ID: 6374-01
Matrix: Aqueous Sampled: 01/04/88 Received: 01/04/88
Authorized: 01/04/88 Prepared: 01/05/88 Analyzed: 01/18/88

Parameter	Result	Units	Reporting Limit
Phenol	ND	µg/L	20
bis(2-Chloroethyl)ether	ND	µg/L	20
2-Chlorophenol	ND	µg/L	20
1,3-Dichlorobenzene	ND	µg/L	20
1,4-Dichlorobenzene	ND	µg/L	20
Benzyl alcohol	ND	µg/L	20
1,2-Dichlorobenzene	ND	µg/L	20
2-Methylphenol	ND	µg/L	20
bis(2-Chloroisopropyl)ether	ND	µg/L	20
4-Methylphenol	ND	µg/L	20
N-Nitroso-di-n-propylamine	ND	µg/L	20
Hexachloroethane	ND	µg/L	20
Nitrobenzene	ND	µg/L	20
Isophorone	ND	µg/L	20
2-Nitrophenol	ND	µg/L	20
2,4-Dimethylphenol	ND	µg/L	20
Benzoic acid	ND	µg/L	100
bis(2-Chloroethoxy)methane	ND	µg/L	20
2,4-Dichlorophenol	ND	µg/L	20
1,2,4-Trichlorobenzene	ND	µg/L	20
Naphthalene	ND	µg/L	20
4-Chloroaniline	ND	µg/L	20
Hexachlorobutadiene	ND	µg/L	20
4-Chloro-3-methylphenol	ND	µg/L	20
2-Methylnaphthalene	ND	µg/L	20
Hexachlorocyclopentadiene	ND	µg/L	20
2,4,6-Trichlorophenol	ND	µg/L	20
2,4,5-Trichlorophenol	ND	µg/L	100
2-Chloronaphthalene	ND	µg/L	20
2-Nitroaniline	ND	µg/L	100
Dimethyl phthalate	ND	µg/L	20
Acenaphthylene	ND	µg/L	20
3-Nitroaniline	ND	µg/L	100
Acenaphthene	ND	µg/L	20

(continued on following page)

ND = Not detected.

HAZARDOUS SUBSTANCE LIST (HSL)
SEMIVOLATILE ORGANICS (CONT.)

EPA Method 625/HSL List

Client Name: Haley & Aldrich, Inc. (Job No. 635401)
Client ID: B100-OW
Laboratory ID: 6374-01
Matrix: Aqueous Sampled: 01/04/88 Received: 01/04/88
Authorized: 01/04/88 Prepared: 01/05/88 Analyzed: 01/18/88

Parameter	Result	Units	Reporting Limit
2,4-Dinitrophenol	ND	µg/L	100
4-Nitrophenol	ND	µg/L	100
Dibenzofuran	ND	µg/L	20
2,4-Dinitrotoluene	ND	µg/L	20
2,6-Dinitrotoluene	ND	µg/L	20
Diethyl phthalate	ND	µg/L	20
4-Chlorophenyl phenyl ether	ND	µg/L	20
Fluorene	ND	µg/L	20
4-Nitroaniline	ND	µg/L	100
4,6-Dinitro-2-methylphenol	ND	µg/L	100
N-Nitrosodiphenylamine ----------	*	µg/L	20
4-Bromophenyl phenyl ether	ND	µg/L	20
Hexachlorobenzene	ND	µg/L	20
Pentachlorophenol	ND	µg/L	100
Phenanthrene	ND	µg/L	20
Anthracene	ND	µg/L	20
Di-n-butyl phthalate	ND	µg/L	20
Fluoranthene	ND	µg/L	20
Pyrene	ND	µg/L	20
Butyl benzyl phthalate	ND	µg/L	20
3,3'-Dichlorobenzidine	ND	µg/L	40
Benzo(a)anthracene	ND	µg/L	20
bis(2-Ethylhexyl)phthalate	ND	µg/L	20
Chrysene	ND	µg/L	20
Di-n-octyl phthalate	ND	µg/L	20
Benzo(b)fluoranthene	ND	µg/L	20
Benzo(k)fluoranthene	ND	µg/L	20
Benzo(a)pyrene	ND	µg/L	20
Indeno(1,2,3-c,d)pyrene	ND	µg/L	20
Dibenzo(a,h)anthracene	ND	µg/L	20
Benzo(g,h,i)perylene	ND	µg/L	20

*Trace concentrations detected below the reporting limit.

ND = Not detected.

Reported by NCR Approved by AVL

HAZARDOUS SUBSTANCE LIST (HSL)
SEMIVOLATILE ORGANICS

EPA Method 625/HSL List

Client Name: Haley & Aldrich, Inc. (Job No. 635401)
Client ID: B102-0W
Laboratory ID: 6374-04
Matrix: Aqueous Sampled: 01/04/88 Received: 01/04/88
Authorized: 01/04/88 Prepared: 01/05/88 Analyzed: 01/18/88

Parameter	Result	Units	Reporting Limit
Phenol	*	µg/L	20
bis(2-Chloroethyl)ether	ND	µg/L	20
2-Chlorophenol	ND	µg/L	20
1,3-Dichlorobenzene	ND	µg/L	20
1,4-Dichlorobenzene	ND	µg/L	20
Benzyl alcohol	ND	µg/L	20
1,2-Dichlorobenzene	ND	µg/L	20
2-Methylphenol	ND	µg/L	20
bis(2-Chloroisopropyl)ether	ND	µg/L	20
4-Methylphenol	ND	µg/L	20
N-Nitroso-di-n-propylamine	ND	µg/L	20
Hexachloroethane	ND	µg/L	20
Nitrobenzene	ND	µg/L	20
Isophorone	ND	µg/L	20
2-Nitrophenol	ND	µg/L	20
2,4-Dimethylphenol	ND	µg/L	20
Benzoic acid	ND	µg/L	100
bis(2-Chloroethoxy)methane	ND	µg/L	20
2,4-Dichlorophenol	ND	µg/L	20
1,2,4-Trichlorobenzene	ND	µg/L	20
Naphthalene	110	µg/L	20
4-Chloroaniline	ND	µg/L	20
Hexachlorobutadiene	ND	µg/L	20
4-Chloro-3-methylphenol	ND	µg/L	20
2-Methylnaphthalene	21	µg/L	20
Hexachlorocyclopentadiene	ND	µg/L	20
2,4,6-Trichlorophenol	ND	µg/L	20
2,4,5-Trichlorophenol	ND	µg/L	100
2-Chloronaphthalene	ND	µg/L	20
2-Nitroaniline	ND	µg/L	100
Dimethyl phthalate	ND	µg/L	20
Acenaphthylene	ND	µg/L	20
3-Nitroaniline	ND	µg/L	100
Acenaphthene	ND	µg/L	20

(continued on following page)

*Trace concentrations detected below the reporting limit.

ND = Not detected.

Enseco

HAZARDOUS SUBSTANCE LIST (HSL)
SEMIVOLATILE ORGANICS (CONT.)

EPA Method 625/HSL List

Client Name: Haley & Aldrich, Inc. (Job No. 635401)
Client ID: B102-OW
Laboratory ID: 6374-04
Matrix: Aqueous Sampled: 01/04/88 Received: 01/04/88
Authorized: 01/04/88 Prepared: 01/05/88 Analyzed: 01/18/88

Parameter	Result	Units	Reporting Limit
2,4-Dinitrophenol	ND	µg/L	100
4-Nitrophenol	ND	µg/L	100
Dibenzofuran	ND	µg/L	20
2,4-Dinitrotoluene	ND	µg/L	20
2,6-Dinitrotoluene	ND	µg/L	20
Diethyl phthalate	ND	µg/L	20
4-Chlorophenyl phenyl ether	ND	µg/L	20
Fluorene	ND	µg/L	20
4-Nitroaniline	ND	µg/L	100
4,6-Dinitro-2-methylphenol	ND	µg/L	100
N-Nitrosodiphenylamine ----------	*	µg/L	20
4-Bromophenyl phenyl ether	ND	µg/L	20
Hexachlorobenzene	ND	µg/L	20
Pentachlorophenol	ND	µg/L	100
Phenanthrene	ND	µg/L	20
Anthracene	ND	µg/L	20
Di-n-butyl phthalate	ND	µg/L	20
Fluoranthene	ND	µg/L	20
Pyrene	ND	µg/L	20
Butyl benzyl phthalate	ND	µg/L	20
3,3'-Dichlorobenzidine	ND	µg/L	40
Benzo(a)anthracene	ND	µg/L	20
bis(2-Ethylhexyl)phthalate	ND	µg/L	20
Chrysene	ND	µg/L	20
Di-n-octyl phthalate	ND	µg/L	20
Benzo(b)fluoranthene	ND	µg/L	20
Benzo(k)fluoranthene	ND	µg/L	20
Benzo(a)pyrene	ND	µg/L	20
Indeno(1,2,3-c,d)pyrene	ND	µg/L	20
Dibenzo(a,h)anthracene	ND	µg/L	20
Benzo(g,h,i)perylene	ND	µg/L	20

*Trace concentrations detected below the reporting limit.

ND = Not detected.

Reported by NCR Approved by AVL



Enseco

PRIORITY POLLUTANT ORGANOCHLORINE PESTICIDES/PCBs

EPA Method 608

Client Name: Haley & Aldrich, Inc. (Job No. 635401)

Client ID: B4-OW

Laboratory ID: 6374-05

Matrix: Aqueous Sampled: 01/04/88 Received: 01/04/88

Authorized: 01/04/88 Prepared: 01/06/88 Analyzed: 01/15/88

Parameter	Result	Units	Reporting Limit
alpha-BHC	ND	µg/L	0.05
beta-BHC	ND	µg/L	0.05
delta-BHC	ND	µg/L	0.05
gamma-BHC (Lindane)	ND	µg/L	0.05
Heptachlor	ND	µg/L	0.05
Aldrin	ND	µg/L	0.05
Heptachlor epoxide	ND	µg/L	0.05
Endosulfan I	ND	µg/L	0.05
Dieldrin	ND	µg/L	0.10
4,4'-DDE	ND	µg/L	0.10
Endrin	ND	µg/L	0.10
Endosulfan II	ND	µg/L	0.10
4,4'-DDD	ND	µg/L	0.10
Endosulfan sulfate	ND	µg/L	0.10
4,4'-DDT	ND	µg/L	0.10
Endrin aldehyde	ND	µg/L	0.10
Methoxychlor	ND	µg/L	0.50
Chlordane	ND	µg/L	0.50
Toxaphene	ND	µg/L	1.0
Aroclor-1016	ND	µg/L	0.50
Aroclor-1221	ND	µg/L	0.50
Aroclor-1232	ND	µg/L	0.50
Aroclor-1242	ND	µg/L	0.50
Aroclor-1248	ND	µg/L	0.50
Aroclor-1254	ND	µg/L	0.50
Aroclor-1260	ND	µg/L	0.50

ND = Not detected.

Reported by JKD Approved by EK

Enseco

PRIORITY POLLUTANT ORGANOCHLORINE PESTICIDES/PCBs

EPA Method 608

Client Name: Haley & Aldrich, Inc. (Job No. 635401)

Client ID: B100-OW

Laboratory ID: 6374-01

Matrix: Aqueous Sampled: 01/04/88 Received: 01/04/88

Authorized: 01/04/88 Prepared: 01/06/88 Analyzed: 01/15/88

Parameter	Result	Units	Reporting Limit
alpha-BHC	ND	µg/L	0.05
beta-BHC	ND	µg/L	0.05
delta-BHC	ND	µg/L	0.05
gamma-BHC (Lindane)	ND	µg/L	0.05
Heptachlor	ND	µg/L	0.05
Aldrin	ND	µg/L	0.05
Heptachlor epoxide	ND	µg/L	0.05
Endosulfan I	ND	µg/L	0.05
Dieldrin	ND	µg/L	0.10
4,4'-DDE	ND	µg/L	0.10
Endrin	ND	µg/L	0.10
Endosulfan II	ND	µg/L	0.10
4,4'-DDD	ND	µg/L	0.10
Endosulfan sulfate	ND	µg/L	0.10
4,4'-DDT	ND	µg/L	0.10
Endrin aldehyde	ND	µg/L	0.10
Methoxychlor	ND	µg/L	0.50
Chlordane	ND	µg/L	0.50
Toxaphene	ND	µg/L	1.0
Aroclor-1016	ND	µg/L	0.50
Aroclor-1221	ND	µg/L	0.50
Aroclor-1232	ND	µg/L	0.50
Aroclor-1242	ND	µg/L	0.50
Aroclor-1248	ND	µg/L	0.50
Aroclor-1254	ND	µg/L	0.50
Aroclor-1260	ND	µg/L	0.50

ND = Not detected.

Reported by JKD Approved by EK

Enseco

PRIORITY POLLUTANT ORGANOCHLORINE PESTICIDES/PCBs

EPA Method 608

Client Name: Haley & Aldrich, Inc. (Job No. 635401)

Client ID: B102-OW

Laboratory ID: 6374-04

Matrix: Aqueous Sampled: 01/04/88 Received: 01/04/88

Authorized: 01/04/88 Prepared: 01/06/88 Analyzed: 01/15/88

Parameter	Result	Units	Reporting Limit
alpha-BHC	ND	µg/L	0.05
beta-BHC	ND	µg/L	0.05
delta-BHC	ND	µg/L	0.05
gamma-BHC (Lindane)	ND	µg/L	0.05
Heptachlor	ND	µg/L	0.05
Aldrin	ND	µg/L	0.05
Heptachlor epoxide	ND	µg/L	0.05
Endosulfan I	ND	µg/L	0.05
Dieldrin	ND	µg/L	0.10
4,4'-DDE	ND	µg/L	0.10
Endrin	ND	µg/L	0.10
Endosulfan II	ND	µg/L	0.10
4,4'-DDD	ND	µg/L	0.10
Endosulfan sulfate	ND	µg/L	0.10
4,4'-DDT	ND	µg/L	0.10
Endrin aldehyde	ND	µg/L	0.10
Methoxychlor	ND	µg/L	0.50
Chlordane	ND	µg/L	0.50
Toxaphene	ND	µg/L	1.0
Aroclor-1016	ND	µg/L	0.50
Aroclor-1221	ND	µg/L	0.50
Aroclor-1232	ND	µg/L	0.50
Aroclor-1242	ND	µg/L	0.50
Aroclor-1248	ND	µg/L	0.50
Aroclor-1254	ND	µg/L	0.50
Aroclor-1260	ND	µg/L	0.50

ND = Not detected.

Reported by JKD Approved by EK

Enseco

HAZARDOUS SUBSTANCE LIST (HSL) VOLATILE ORGANICS

EPA Method 624/HSL List

Client Name: Haley & Aldrich, Inc. (Job No. 635401)

Client ID: B2-OW

Laboratory ID: 6374-03

Matrix: Aqueous Sampled: 01/04/88 Received: 01/04/88

Authorized: 01/04/88 Prepared: 01/09/88 Analyzed: 01/09/88

Parameter	Result	Units	Reporting Limit
Chloromethane	ND	µg/L	5
Bromomethane	ND	µg/L	5
Vinyl chloride	ND	µg/L	5
Chloroethane	ND	µg/L	5
Methylene chloride	ND	µg/L	5
Acetone	ND	µg/L	50
Carbon disulfide	ND	µg/L	2
1,1-Dichloroethene	ND	µg/L	2
1,1-Dichloroethane	ND	µg/L	2
trans-1,2-Dichloroethene	ND	µg/L	2
Chloroform	ND	µg/L	2
1,2-Dichloroethane	ND	µg/L	2
2-Butanone	ND	µg/L	10
1,1,1-Trichloroethane	ND	µg/L	2
Carbon tetrachloride	ND	µg/L	2
Vinyl acetate	ND	µg/L	10
Bromodichloromethane	ND	µg/L	2
1,2-Dichloropropane	ND	µg/L	2
trans-1,3-Dichloropropene	ND	µg/L	2
Trichloroethene	ND	µg/L	2
Dibromochloromethane	ND	µg/L	2
1,1,2-Trichloroethane	ND	µg/L	2
Benzene	ND	µg/L	2
cis-1,3-Dichloropropene	ND	µg/L	2
2-Chloroethyl vinyl ether	ND	µg/L	10
Bromoform	ND	µg/L	2
4-Methyl-2-pentanone	ND	µg/L	10
2-Hexanone	ND	µg/L	10
1,1,2,2-Tetrachloroethane	ND	µg/L	2
Tetrachloroethene	ND	µg/L	2
Toluene	ND	µg/L	2
Chlorobenzene	ND	µg/L	2
Ethyl benzene	ND	µg/L	2
Styrene	ND	µg/L	2
Total xylenes	ND	µg/L	2

ND = Not detected.

Reported by SA Approved by

Enseco

HAZARDOUS SUBSTANCE LIST (HSL) VOLATILE ORGANICS

EPA Method 624/HSL List

Client Name: Haley & Aldrich, Inc. (Job No. 635401)

Client ID: B4-OW

Laboratory ID: 6374-05

Matrix: Aqueous Sampled: 01/04/88 Received: 01/04/88

Authorized: 01/04/88 Prepared: 01/08/88 Analyzed: 01/08/88

Parameter	Result	Units	Reporting Limit
Chloromethane	ND	µg/L	5
Bromomethane	ND	µg/L	5
Vinyl chloride	ND	µg/L	5
Chloroethane	ND	µg/L	5
Methylene chloride	ND	µg/L	5
Acetone	ND	µg/L	50
Carbon disulfide	ND	µg/L	2
1,1-Dichloroethene	ND	µg/L	2
1,1-Dichloroethane	ND	µg/L	2
trans-1,2-Dichloroethene	ND	µg/L	2
Chloroform	ND	µg/L	2
1,2-Dichloroethane	ND	µg/L	2
2-Butanone	ND	µg/L	10
1,1,1-Trichloroethane	ND	µg/L	2
Carbon tetrachloride	ND	µg/L	2
Vinyl acetate	ND	µg/L	10
Bromodichloromethane	ND	µg/L	2
1,2-Dichloropropane	ND	µg/L	2
trans-1,3-Dichloropropene	ND	µg/L	2
Trichloroethene	ND	µg/L	2
Dibromochloromethane	ND	µg/L	2
1,1,2-Trichloroethane	ND	µg/L	2
Benzene	ND	µg/L	2
cis-1,3-Dichloropropene	ND	µg/L	2
2-Chloroethyl vinyl ether	ND	µg/L	10
Bromoform	ND	µg/L	2
4-Methyl-2-pentanone	ND	µg/L	10
2-Hexanone	ND	µg/L	10
1,1,2,2-Tetrachloroethane	ND	µg/L	2
Tetrachloroethene	ND	µg/L	2
Toluene	ND	µg/L	2
Chlorobenzene	ND	µg/L	2
Ethyl benzene	ND	µg/L	2
Styrene	ND	µg/L	2
Total xylenes	ND	µg/L	2

ND = Not detected.

Reported by SA Approved by

Enseco

HAZARDOUS SUBSTANCE LIST (HSL) VOLATILE ORGANICS

EPA Method 624/HSL List

Client Name: Haley & Aldrich, Inc. (Job No. 635401)

Client ID: B100-OW

Laboratory ID: 6374-01

Matrix: Aqueous Sampled: 01/04/88 Received: 01/04/88

Authorized: 01/04/88 Prepared: 01/09/88 Analyzed: 01/09/88

Parameter	Result	Units	Reporting Limit
Chloromethane	ND	µg/L	5
Bromomethane	ND	µg/L	5
Vinyl chloride	ND	µg/L	5
Chloroethane	ND	µg/L	5
Methylene chloride	ND	µg/L	5
Acetone	ND	µg/L	50
Carbon disulfide	ND	µg/L	2
1,1-Dichloroethene	ND	µg/L	2
1,1-Dichloroethane	ND	µg/L	2
trans-1,2-Dichloroethene	ND	µg/L	2
Chloroform	ND	µg/L	2
1,2-Dichloroethane	ND	µg/L	2
2-Butanone	ND	µg/L	10
1,1,1-Trichloroethane	ND	µg/L	2
Carbon tetrachloride	ND	µg/L	2
Vinyl acetate	ND	µg/L	10
Bromodichloromethane	ND	µg/L	2
1,2-Dichloropropane	ND	µg/L	2
trans-1,3-Dichloropropene	ND	µg/L	2
Trichloroethene	ND	µg/L	2
Dibromochloromethane	ND	µg/L	2
1,1,2-Trichloroethane	ND	µg/L	2
Benzene	ND	µg/L	2
cis-1,3-Dichloropropene	ND	µg/L	2
2-Chloroethyl vinyl ether	ND	µg/L	10
Bromoform	ND	µg/L	2
4-Methyl-2-pentanone	ND	µg/L	10
2-Hexanone	ND	µg/L	10
1,1,2,2-Tetrachloroethane	ND	µg/L	2
Tetrachloroethene	ND	µg/L	2
Toluene	ND	µg/L	2
Chlorobenzene	ND	µg/L	2
Ethyl benzene	ND	µg/L	2
Styrene	ND	µg/L	2
Total xylenes	ND	µg/L	2

ND = Not detected.

Reported by SA Approved by CB

Enseco

HAZARDOUS SUBSTANCE LIST (HSL) VOLATILE ORGANICS

EPA Method 624/HSL List

Client Name: Haley & Aldrich, Inc. (Job No. 635401)

Client ID: B102-OW

Laboratory ID: 6374-04

Matrix: Aqueous Sampled: 01/04/88 Received: 01/04/88

Authorized: 01/04/88 Prepared: 01/09/88 Analyzed: 01/09/88

Parameter	Result	Units	Reporting Limit
Chloromethane	ND	µg/L	50
Bromomethane	ND	µg/L	50
Vinyl chloride	ND	µg/L	50
Chloroethane	ND	µg/L	50
Methylene chloride	ND	µg/L	50
Acetone	ND	µg/L	500
Carbon disulfide	ND	µg/L	20
1,1-Dichloroethene	ND	µg/L	20
1,1-Dichloroethane	ND	µg/L	20
trans-1,2-Dichloroethene	ND	µg/L	20
Chloroform	ND	µg/L	20
1,2-Dichloroethane	ND	µg/L	20
2-Butanone	ND	µg/L	100
1,1,1-Trichloroethane	ND	µg/L	20
Carbon tetrachloride	ND	µg/L	20
Vinyl acetate	ND	µg/L	100
Bromodichloromethane	ND	µg/L	20
1,2-Dichloropropane	ND	µg/L	20
trans-1,3-Dichloropropene	ND	µg/L	20
Trichloroethene	ND	µg/L	20
Dibromochloromethane	ND	µg/L	20
1,1,2-Trichloroethane	ND	µg/L	20
Benzene	170	µg/L	20
cis-1,3-Dichloropropene	ND	µg/L	20
2-Chloroethyl vinyl ether	ND	µg/L	100
Bromoform	ND	µg/L	20
4-Methyl-2-pentanone	ND	µg/L	100
2-Hexanone	ND	µg/L	100
1,1,2,2-Tetrachloroethane	ND	µg/L	20
Tetrachloroethene	ND	µg/L	20
Toluene	ND	µg/L	20
Chlorobenzene	ND	µg/L	20
Ethyl benzene	280	µg/L	20
Styrene	ND	µg/L	20
Total xylenes	470	µg/L	20

ND = Not detected.

Reported by SA Approved by CB

Enseco

PRIORITY POLLUTANT METALS

Client Name: Haley & Aldrich, Inc. (Job No. 635401)
Client ID: B4-OW
Laboratory ID: 6374-05
Matrix: Aqueous Sampled: 01/04/88 Received: 01/04/88
Authorized: 01/04/88 Prepared: 01/11/88 Analyzed: 01/14/88

Parameter	Result	Units	Reporting Limit	Analytical Method
Antimony	ND	mg/L	0.05	200.7
Arsenic	0.017	mg/L	0.005	206.2
Beryllium	0.0035	mg/L	0.001	200.7
Cadmium	ND	mg/L	0.005	200.7
Chromium	0.20	mg/L	0.01	200.7
Copper	0.33	mg/L	0.006	200.7
Lead	0.17	mg/L	0.01	239.2
Mercury	0.00035	mg/L	0.0002	245.1
Nickel	0.13	mg/L	0.04	200.7
Selenium	ND	mg/L	0.005	270.2
Silver	ND	mg/L	0.005	200.7
Thallium	ND	mg/L	0.01	279.2
Zinc	0.47	mg/L	0.01	200.7

ND = Not detected.

Reported by CAK Approved by MDC

Enseco

PRIORITY POLLUTANT METALS

Client Name: Haley & Aldrich, Inc. (Job No. 635401)
Client ID: B100-OW
Laboratory ID: 6374-01
Matrix: Aqueous Sampled: 01/04/88 Received: 01/04/88
Authorized: 01/04/88 Prepared: 01/11/88 Analyzed: 01/14/88

Parameter	Result	Units	Reporting Limit	Analytical Method
Antimony	ND	mg/L	0.05	200.7
Arsenic	ND	mg/L	0.005	206.2
Beryllium	ND	mg/L	0.001	200.7
Cadmium	ND	mg/L	0.005	200.7
Chromium	ND	mg/L	0.01	200.7
Copper	ND	mg/L	0.006	200.7
Lead	ND	mg/L	0.01	239.2
Mercury	ND	mg/L	0.0002	245.1
Nickel	ND	mg/L	0.04	200.7
Selenium	0.0089	mg/L	0.005	270.2
Silver	ND	mg/L	0.005	200.7
Thallium	ND	mg/L	0.01	279.2
Zinc	0.015	mg/L	0.01	200.7

ND = Not detected.

Reported by CAK Approved by

Enseco

PRIORITY POLLUTANT METALS

Client Name: Haley & Aldrich, Inc. (Job No. 635401)
Client ID: B101-OW
Laboratory ID: 6374-02
Matrix: Aqueous Sampled: 01/04/88 Received: 01/04/88
Authorized: 01/04/88 Prepared: 01/11/88 Analyzed: 01/14/88

Parameter	Result	Units	Reporting Limit	Analytical Method
Antimony	ND	mg/L	0.05	200.7
Arsenic	ND	mg/L	0.005	206.2
Beryllium	ND	mg/L	0.001	200.7
Cadmium	ND	mg/L	0.005	200.7
Chromium	ND	mg/L	0.01	200.7
Copper	ND	mg/L	0.006	200.7
Lead	ND	mg/L	0.01	239.2
Mercury	ND	mg/L	0.0002	245.1
Nickel	ND	mg/L	0.04	200.7
Selenium ----------	0.0058	mg/L	0.005	270.2
Silver	ND	mg/L	0.005	200.7
Thallium	ND	mg/L	0.01	279.2
Zinc	ND	mg/L	0.01	200.7

ND = Not detected.

Reported by CAK Approved by ADC



Enseco

PRIORITY POLLUTANT METALS

Client Name: Haley & Aldrich, Inc. (Job No. 635401)
Client ID: B102-OW
Laboratory ID: 6374-04
Matrix: Aqueous Sampled: 01/04/88 Received: 01/04/88
Authorized: 01/04/88 Prepared: 01/11/88 Analyzed: 01/14/88

Parameter	Result	Units	Reporting Limit	Analytical Method
Antimony	ND	mg/L	0.05	200.7
Arsenic	0.0077	mg/L	0.005	206.2
Beryllium	ND	mg/L	0.001	200.7
Cadmium	ND	mg/L	0.005	200.7
Chromium	ND	mg/L	0.01	200.7
Copper	ND	mg/L	0.006	200.7
Lead	ND	mg/L	0.01	239.2
Mercury	ND	mg/L	0.0002	245.1
Nickel	ND	mg/L	0.04	200.7
Selenium	ND	mg/L	0.005	270.2
Silver	ND	mg/L	0.005	200.7
Thallium	ND	mg/L	0.01	279.2
Zinc	0.010	mg/L	0.01	200.7

ND = Not detected.

Reported by CAK Approved by MDC

Enseco

CLIENT: Haley & Aldrich, Inc. (Job No. 635401) INORGANIC ANALYSIS

SAMPLE RECEIVED: 01/04/88

ANALYSIS COMPLETED: 01/20/88

RESULTS IN: mg/L (ppm)*

REPORTED BY: JJ - PR

CHECKED BY: EO - Data Report -

Erco ID	Client ID	Cyanide, Total
6374-01	B100-OW	<0.010
6374-03	B2-OW	0.015
6374-04	B102-OW	<0.010
6374-05	B4-OW	<0.010
Erco Blank		<0.010
Laboratory Control Spike		103%
Laboratory Control Spike Dup.		102%
Method Used:		335.2

If customer has any questions regarding analysis, refer to sample in question by its Erco ID#.

*Unless otherwise indicated.

Enseco

PETROLEUM HYDROCARBON ANALYSIS BY IR

EPA Method 418.1

Client Name: Haley & Aldrich, Inc. (Job No. 635401)
Client ID: B2-OW
Laboratory ID: 6374-03
Matrix: Aqueous Sampled: 01/04/88 Received: 01/04/88
Authorized: 01/04/88 Prepared: 01/05/88 Analyzed: 01/07/88

Parameter	Result	Units	Reporting Limit
Petroleum hydrocarbon	1.3	mg/L	0.5

Reported by AN Approved by MEF

Enseco

PETROLEUM HYDROCARBON ANALYSIS BY IR

EPA Method 418.1

Client Name: Haley & Aldrich, Inc. (Job No. 635401)

Client ID: B4-OW

Laboratory ID: 6374-05

Matrix: Aqueous Sampled: 01/04/88 Received: 01/04/88

Authorized: 01/04/88 Prepared: 01/05/88 Analyzed: 01/07/88

Parameter	Result	Units	Reporting Limit
Petroleum hydrocarbon ----------	0.7	mg/L	0.5

Reported by AJ Approved by MEF

Enseco

PETROLEUM HYDROCARBON ANALYSIS BY IR

EPA Method 418.1

Client Name: Haley & Aldrich, Inc. (Job No. 635401)
Client ID: B100-OW
Laboratory ID: 6374-01
Matrix: Aqueous Sampled: 01/04/88 Received: 01/04/88
Authorized: 01/04/88 Prepared: 01/05/88 Analyzed: 01/07/88

Parameter	Result	Units	Reporting Limit
Petroleum hydrocarbon	ND	mg/L	0.5

ND = Not detected.

Reported by JKD Approved by MEF

Enseco

PETROLEUM HYDROCARBON ANALYSIS BY IR

EPA Method 418.1

Client Name: Haley & Aldrich, Inc. (Job No. 635401)
Client ID: B102-OW
Laboratory ID: 6374-04
Matrix: Aqueous Sampled: 01/04/88 Received: 01/04/88
Authorized: 01/04/88 Prepared: 01/05/88 Analyzed: 01/07/88

Parameter	Result	Units	Reporting Limit
Petroleum hydrocarbon ----------	1.6	mg/L	0.5

Reported by AN Approved by MEF

APPENDIX E

Laboratory Quality Assurance/ Quality Control Documentation

6369

HALEY & ALDRICH, INC.
Bedford, NH

CHAIN OF CUSTODY RECORD

PAGE 1 OF 1

H&A FILE NO. 27 6354 01
PROJECT Charlestown Navy Yard
H&A CONTACT Keith DuBois

LABORATORY ENSECO
ADDRESS 305 Alewife Brook Pkwy Cambridge
CONTACT Dallas Wait

DELIVERY DATE 31 DECEMBER 1987
DATE FINAL REPORT DUE ~~31 JAN 1988~~ 21 JAN 1988
PROJECT MANAGER'S INITIALS HKD

H&A SAMPLE NO.	LABORATORY SAMPLE NO.	SAMPLING DATE	SAMPLING TIME	SAMPLE DEPTH	SAMPLE TYPE	ANALYSES: VOA	ABN	METALS	PEST/PCB	PET. ID	O&G	PHER	Eprox & METALS	<Volatile EPA list		NO. OF CONTAINERS	COMMENTS (Special instructions, cautions, etc.)
B100-S2	6369-01	~~12/30/87~~	0805	3-5'	Soil				X			X	+			2	PET I.D. = Fingerprint
B100-S5	6369-02	12/30/87	0900	10-12'	Soil							X				1	
TP2-S1	6369-03	12/31/87	0845	0-4.1	Soil				X				X			2	
TP2-S2	6369-04	12/31/87	0845	6-10.5	Soil									X		1	
TP1-S1	6369-05	12/31/87	0820	0-6.7	Soil				X			X	X			3	
TP3-S1	6369-06	12/31/87	0900	0-5.0	Soil				X	X			X			[illegible]	-2 HKD
TP3-S2	6369-07	12/31/87	0900	5-8.0	Soil					X						[illegible]	
B102-S5	6369-08	12/30/87	1400	10-12	Soil							X				1	
B101-S3	6369-09	12/30/87	1100	10-12	Soil									X		1	
TP5-S2	6369-10	12/31/87	0945	4.5-12.0	Soil									X		1	

I. Sampled and Relinquished by
Sign H. Keith DuBois
Print H. Keith DuBois
Firm Haley & Aldrich, Inc.
Date 12/31/87 Time 1505

I. Received by
Sign James Hammack
Print JAMES HAMMACK
Firm ENSECO/CEC
Date 12/31/87 Time 1505

II. Relinquished by
Sign
Print
Firm
Date Time

II. Received by
Sign
Print
Firm
Date Time

III. Relinquished by
Sign
Print
Firm
Date Time

III. Received by
Sign
Print
Firm
Date Time

IV. Relinquished by
Sign
Print
Firm
Date Time

IV. Received by
Sign
Print
Firm
Date Time

Evidence Samples tampered with? ☒ No ☐ Yes

	LIQUID	SOLID
VOA Vial		
Glass Bottle		
PlasticBottle		
Preser-vative		
Container Volume		
VOA Vial		
Glass Jar		X X X X X X
Plastic Jar		
Preser-vative		A A A A A
Container Volume		6 08 6 02 6 02 12 08 6 02

Note: Sample bottles supplied by lab, unless indicated.

PRESERVATION KEY: A - Sample chilled,
B [illegible]

REMARKS: (Sample storage, nonstandard sample bottles)

Enseco

PETROLEUM HYDROCARBON ANALYSIS BY IR

EPA Method 418.1

Client Name: Haley & Aldrich, Inc. (Job No. 635401)
Client ID: Erco Blank
Laboratory ID: 6300-01B
Matrix: Solid Sampled: NA Received: NA
Authorized: NA Prepared: 01/04/88 Analyzed: 01/13/88

Parameter	Result	Units	Reporting Limit
Petroleum hydrocarbon	ND	µg/g (dry wt)	20

Solid content = 100%

NA = Not appicable.
ND = Not detected.

Reported by AJ Approved by MEF

Enseco

HYDROCARBON FINGERPRINTING
U.S. COAST GUARD OIL SPILL IDENTIFICATION SYSTEM
MARINE ORGANICS LABORATORY

Client Name: Haley & Aldrich, Inc. (Job No. 635401)
Matrix: Solid
Authorized: NA Sampled: NA Received: NA
Concentration Units: µg/g (ppm) Prepared: 01/05/88 Analyzed: 01/17/87

Enseco ID	Client ID	Total Petroleum Hydro-carbons	Reporting Limits for Individual Hydrocarbons	Reporting Limits for Total Product	% Solids
6370-01B	Erco Blank	ND	0.2	5.0	NA

Qualitative Identification: NA

NA = Not applicable.
ND = Not detected at or above reporting limit.
All samples are corrected for Method Blank.
Minimum reporting limit for individual hydrocarbons = 0.2 µg/g (dry wt).
Minimum reporting limit for total products = 5.0 µg/g (dry wt).
Internal standard recovery = 91%.

Reported by mm Approved by MH

EP TOXICITY METALS

Client Name: Commercial Client Blank
Client ID: EP Tox Blank 3-2
Laboratory ID: EP Tox Blank 3-2
Matrix: Solid Sampled: NA Received: NA
Authorized: NA Prepared: 01/12/88 Analyzed: 01/20/88

Parameter	Result in Leachate	Units	Reporting Limit	Regulated Limit in Leachate	Analytical Method
Arsenic	ND	mg/L	0.25	5	7060/200.7
Barium	ND	mg/L	2.0	100	7080/200.7
Cadmium	ND	mg/L	0.05	1	7130/200.7
Chromium	ND	mg/L	0.2	5	7190/200.7
Lead	ND	mg/L	0.25	5	7420/200.7
Mercury	ND	mg/L	0.001	0.2	7470
Selenium	ND	mg/L	0.02	1	7740
Silver	ND	mg/L	0.025	5	7760/200.7

NA = Not applicable.
ND = Not detected.

Reported by _____ Approved by _____

PRIORITY POLLUTANT ORGANOCHLORINE PESTICIDES/PCBs

EPA Method 8080

Client Name: Haley & Aldrich, Inc. (Job No. 635401)

Client ID: Erco Blank

Laboratory ID: 6369-01B

Matrix: Solid Sampled: NA Received: NA

Authorized: NA Prepared: 01/07/88 Analyzed: 01/20/88

Parameter	Result	Units	Reporting Limit
alpha-BHC	ND	µg/kg (dry wt)	4
beta-BHC	ND	µg/kg (dry wt)	4
delta-BHC	ND	µg/kg (dry wt)	4
gamma-BHC (Lindane)	ND	µg/kg (dry wt)	4
Heptachlor	ND	µg/kg (dry wt)	4
Aldrin	ND	µg/kg (dry wt)	4
Heptachlor epoxide	ND	µg/kg (dry wt)	4
Endosulfan I	ND	µg/kg (dry wt)	4
Dieldrin	ND	µg/kg (dry wt)	8
4,4'-DDE	ND	µg/kg (dry wt)	8
Endrin	ND	µg/kg (dry wt)	8
Endosulfan II	ND	µg/kg (dry wt)	8
4,4'-DDD	ND	µg/kg (dry wt)	8
Endosulfan sulfate	ND	µg/kg (dry wt)	8
4,4'-DDT	ND	µg/kg (dry wt)	8
Endrin aldehyde	ND	µg/kg (dry wt)	8
Methoxychlor	ND	µg/kg (dry wt)	40
Chlordane	ND	µg/kg (dry wt)	40
Toxaphene	ND	µg/kg (dry wt)	80
Aroclor-1016	ND	µg/kg (dry wt)	40
Aroclor-1221	ND	µg/kg (dry wt)	40
Aroclor-1232	ND	µg/kg (dry wt)	40
Aroclor-1242	ND	µg/kg (dry wt)	40
Aroclor-1248	ND	µg/kg (dry wt)	40
Aroclor-1254	ND	µg/kg (dry wt)	40
Aroclor-1260	ND	µg/kg (dry wt)	40

Solid content = 100%

NA = Not applicable.

ND = Not detected.

Reported by MEF Approved by EE

Enseco

PRIORITY POLLUTANT ORGANOCHLORINE PESTICIDES/PCBs

EPA Method 8080

Client Name: Haley & Aldrich, Inc. (Job No. 635401)

Client ID: Laboratory Control Spike

Laboratory ID: 6369-01BS

Matrix: Solid Sampled: NA Received: NA

Authorized: NA Prepared: 01/07/88 Analyzed: 01/20/88

Parameter	Result**	Units	Reporting Limit
alpha-BHC	ND	µg/kg (dry wt)	4
beta-BHC	ND	µg/kg (dry wt)	4
delta-BHC	ND	µg/kg (dry wt)	4
gamma-BHC (Lindane)	6.6 (82)	µg/kg (dry wt)	4
Heptachlor	6.2 (77)	µg/kg (dry wt)	4
Aldrin	5.7 (71)	µg/kg (dry wt)	4
Heptachlor epoxide	ND	µg/kg (dry wt)	4
Endosulfan I	ND	µg/kg (dry wt)	4
Dieldrin	22 (108)	µg/kg (dry wt)	8
4,4'-DDE	ND	µg/kg (dry wt)	8
Endrin	23 (115)	µg/kg (dry wt)	8
Endosulfan II	ND	µg/kg (dry wt)	8
4,4'-DDD	ND	µg/kg (dry wt)	8
Endosulfan sulfate	ND	µg/kg (dry wt)	8
4,4'-DDT	23 (115)	µg/kg (dry wt)	8
Endrin aldehyde	ND	µg/kg (dry wt)	8
Methoxychlor	ND	µg/kg (dry wt)	40
Chlordane	ND	µg/kg (dry wt)	40
Toxaphene	ND	µg/kg (dry wt)	80
Aroclor-1016	ND	µg/kg (dry wt)	40
Aroclor-1221	ND	µg/kg (dry wt)	40
Aroclor-1232	ND	µg/kg (dry wt)	40
Aroclor-1242	ND	µg/kg (dry wt)	40
Aroclor-1248	ND	µg/kg (dry wt)	40
Aroclor-1254	ND	µg/kg (dry wt)	40
Aroclor-1260	ND	µg/kg (dry wt)	40

Solid content = 100%

**Value in parentheses represents percent spike recovery.

NA = Not applicable.

ND = Not detected.

Reported by MEF Approved by ER

Enseco

PRIORITY POLLUTANT PESTICIDES/PCB

EPA Method 8080

QUALITY CONTROL

Client Name: Haley & Aldrich, Inc. (Job No. 635401)

Client ID: Laboratory Control Spike

Laboratory ID: 6369-01BS

Matrix: Solid Sampled: NA Received: NA

Authorized: NA Prepared: 01/07/88 Analyzed: 01/20/88

Parameter	% Recovery	QC Advisory Limits
Lindane	82	46 - 127%
Heptachlor	77	35 - 130%
Aldrin	71	34 - 132%
Dieldrin	108	31 - 134%
Endrin	115	42 - 139%
P.P.'-DDT	115	23 - 134%

NA = Not applicable.

Reported by MFF Approved by EK

Enseco

PRIORITY POLLUTANT ORGANOCHLORINE PESTICIDES/PCBs

EPA Method 8080

Client Name: Haley & Aldrich, Inc. (Job No. 635401)

Client ID: Laboratory Control Spike Dup.

Laboratory ID: 6369-01BSD

Matrix: Solid Sampled: NA Received: NA

Authorized: NA Prepared: 01/07/88 Analyzed: 01/20/88

Parameter	Result**	Units	Reporting Limit
alpha-BHC	ND	µg/kg (dry wt)	4
beta-BHC	ND	µg/kg (dry wt)	4
delta-BHC	ND	µg/kg (dry wt)	4
gamma-BHC (Lindane)	6.6 (83)	µg/kg (dry wt)	4
Heptachlor	7.3 (91)	µg/kg (dry wt)	4
Aldrin	8.9 (111)	µg/kg (dry wt)	4
Heptachlor epoxide	ND	µg/kg (dry wt)	4
Endosulfan I	ND	µg/kg (dry wt)	4
Dieldrin	24 (119)	µg/kg (dry wt)	8
4,4'-DDE	ND	µg/kg (dry wt)	8
Endrin	12 (63)	µg/kg (dry wt)	8
Endosulfan II	ND	µg/kg (dry wt)	8
4,4'-DDD	ND	µg/kg (dry wt)	8
Endosulfan sulfate	ND	µg/kg (dry wt)	8
4,4'-DDT	23 (115)	µg/kg (dry wt)	8
Endrin aldehyde	ND	µg/kg (dry wt)	8
Methoxychlor	ND	µg/kg (dry wt)	40
Chlordane	ND	µg/kg (dry wt)	40
Toxaphene	ND	µg/kg (dry wt)	80
Aroclor-1016	ND	µg/kg (dry wt)	40
Aroclor-1221	ND	µg/kg (dry wt)	40
Aroclor-1232	ND	µg/kg (dry wt)	40
Aroclor-1242	ND	µg/kg (dry wt)	40
Aroclor-1248	ND	µg/kg (dry wt)	40
Aroclor-1254	ND	µg/kg (dry wt)	40
Aroclor-1260	ND	µg/kg (dry wt)	40

Solid content = 100%

**Value in parentheses represents percent spike recovery.

NA = Not applicable.

ND = Not detected.

Reported by MEF Approved by EK

Enseco

PRIORITY POLLUTANT PESTICIDES/PCB

EPA Method 8080

QUALITY CONTROL

Client Name: Haley & Aldrich, Inc. (Job No. 635401)

Client ID: Laboratory Control Spike Dup.

Laboratory ID: 6369-01BSD

Matrix: Solid Sampled: NA Received: NA

Authorized: NA Prepared: 01/07/88 Analyzed: 01/20/88

Parameter	% Recovery	QC Advisory Limits
Lindane	83	46 - 127%
Heptachlor	91	35 - 130%
Aldrin	111	34 - 132%
Dieldrin	119	31 - 134%
Endrin	63	42 - 139%
P.P.'-DDT	115	23 - 134%

NA = Not applicable.

Reported by MEF Approved by EL

Bedford, NH office

HALEY & ALDRICH, INC.
239 Main Street Cambridge, MA 02142
Tel. 617/492 6460

CHAIN OF CUSTODY RECORD

PAGE 1 OF 1

H&A FILE NO. 27 635 401
PROJECT Charlestown Navy Yard
H&A CONTACT K. DuBois

LABORATORY ENSECO
ADDRESS 305 Alewife Brk Pkwy
CONTACT Dallas Wuif

DELIVERY DATE 4 JAN 1988
DATE FINAL REPORT DUE 30 JAN 1988
PROJECT MANAGER'S INITIALS HKD

H&A SAMPLE NO.	LABORATORY SAMPLE NO.	SAMPLING DATE	SAMPLING TIME	SAMPLE DEPTH	SAMPLE TYPE	ANALYSES: VOA	ABN	METALS	PEST/PCB	PCBs	[illegible]	PHEN	CN			NO. OF CONTAINERS	COMMENTS (Special instructions, cautions, etc.)
B100-OW	6374-01	1-4-88	1140		GW	X	X	X	X			+	+			8	
B101-OW	6374-02	1-4-88	1310		GW			X								2	
B2-OW	6374-03	1-4-88	1410		GW	X						X	X			5	
B102-OW	6374-04	1-4-88	1415		GW	X	X	X	X			X	X			7	
B4-OW	6374-05	1-4-88	1530		GW	X	X	X	X			X	X			7	

I. Sampled and Relinquished by
Sign H. Keith DuBois
Print H. Keith DuBois
Firm Haley & Aldrich, Inc.
Date 1-4-88 Time 1735

II. Relinquished by
Sign
Print
Firm
Date Time

III. Relinquished by
Sign
Print
Firm
Date Time

IV. Relinquished by
Sign
Print
Firm
Date Time

I. Received by
Sign [illegible]
Print [illegible]
Firm CRL
Date 4/04/88 Time 1715

II. Received by
Sign
Print
Firm
Date Time

III. Received by
Sign
Print
Firm
Date Time

IV. Received by
Sign
Print
Firm
Date Time

LIQUID	VOA Vial	X										
	Glass Bottle		X		X				X	X		
	PlasticBottle			Y								
	Preservative	A	B4	E					A	A		
	Container Volume	40 ml	1L	1L	1L				2L	500		
SOLID	VOA Vial											
	Glass Jar											
	Plastic Jar											
	Preservative											
	Container Volume											

REMARKS. (Sample storage, nonstandard sample bottles)

Note: Sample bottles supplied by lab, unless indicated

PRESERVATION KEY: A - Sample chilled, B - Filtered, C - Acidified with HNO3

Were Samples tampered with? ☒ No ☐ Yes

HAZARDOUS SUBSTANCE LIST (HSL)
SEMIVOLATILE ORGANICS

EPA Method 625/HSL List

Client Name: Haley & Aldrich, Inc. (Job No. 635401)
Client ID: Erco Blank
Laboratory ID: 6374-05B
Matrix: Aqueous Sampled: NA Received: NA
Authorized: NA Prepared: 01/05/88 Analyzed: 01/18/88

Parameter	Result	Units	Reporting Limit
Phenol	ND	µg/L	10
bis(2-Chloroethyl)ether	ND	µg/L	10
2-Chlorophenol	ND	µg/L	10
1,3-Dichlorobenzene	ND	µg/L	10
1,4-Dichlorobenzene	ND	µg/L	10
Benzyl alcohol	ND	µg/L	10
1,2-Dichlorobenzene	ND	µg/L	10
2-Methylphenol	ND	µg/L	10
bis(2-Chloroisopropyl)ether	ND	µg/L	10
4-Methylphenol	ND	µg/L	10
N-Nitroso-di-n-propylamine	ND	µg/L	10
Hexachloroethane	ND	µg/L	10
Nitrobenzene	ND	µg/L	10
Isophorone	ND	µg/L	10
2-Nitrophenol	ND	µg/L	10
2,4-Dimethylphenol	ND	µg/L	10
Benzoic acid	ND	µg/L	50
bis(2-Chloroethoxy)methane	ND	µg/L	10
2,4-Dichlorophenol	ND	µg/L	10
1,2,4-Trichlorobenzene	ND	µg/L	10
Naphthalene	ND	µg/L	10
4-Chloroaniline	ND	µg/L	10
Hexachlorobutadiene	ND	µg/L	10
4-Chloro-3-methylphenol	ND	µg/L	10
2-Methylnaphthalene	ND	µg/L	10
Hexachlorocyclopentadiene	ND	µg/L	10
2,4,6-Trichlorophenol	ND	µg/L	10
2,4,5-Trichlorophenol	ND	µg/L	50
2-Chloronaphthalene	ND	µg/L	10
2-Nitroaniline	ND	µg/L	50
Dimethyl phthalate	ND	µg/L	10
Acenaphthylene	ND	µg/L	10
3-Nitroaniline	ND	µg/L	50
Acenaphthene	ND	µg/L	10

(continued on following page)

NA = Not applicable.

ND = Not detected.

HAZARDOUS SUBSTANCE LIST (HSL)
SEMIVOLATILE ORGANICS (CONT.)

EPA Method 625/HSL List

Client Name: Haley & Aldrich, Inc. (Job No. 635401)
Client ID: Erco Blank
Laboratory ID: 6374-05B
Matrix: Aqueous Sampled: NA Received: NA
Authorized: NA Prepared: 01/05/88 Analyzed: 01/18/88

Parameter	Result	Units	Reporting Limit
2,4-Dinitrophenol	ND	µg/L	50
4-Nitrophenol	ND	µg/L	50
Dibenzofuran	ND	µg/L	10
2,4-Dinitrotoluene	ND	µg/L	10
2,6-Dinitrotoluene	ND	µg/L	10
Diethyl phthalate	ND	µg/L	10
4-Chlorophenyl phenyl ether	ND	µg/L	10
Fluorene	ND	µg/L	10
4-Nitroaniline	ND	µg/L	50
4,6-Dinitro-2-methylphenol	ND	µg/L	50
N-Nitrosodiphenylamine	ND	µg/L	10
4-Bromophenyl phenyl ether	ND	µg/L	10
Hexachlorobenzene	ND	µg/L	10
Pentachlorophenol	ND	µg/L	50
Phenanthrene	ND	µg/L	10
Anthracene	ND	µg/L	10
Di-n-butyl phthalate ----------	*	µg/L	10
Fluoranthene	ND	µg/L	10
Pyrene	ND	µg/L	10
Butyl benzyl phthalate	ND	µg/L	10
3,3'-Dichlorobenzidine	ND	µg/L	20
Benzo(a)anthracene	ND	µg/L	10
bis(2-Ethylhexyl)phthalate	ND	µg/L	10
Chrysene	ND	µg/L	10
Di-n-octyl phthalate	ND	µg/L	10
Benzo(b)fluoranthene	ND	µg/L	10
Benzo(k)fluoranthene	ND	µg/L	10
Benzo(a)pyrene	ND	µg/L	10
Indeno(1,2,3-c,d)pyrene	ND	µg/L	10
Dibenzo(a,h)anthracene	ND	µg/L	10
Benzo(g,h,i)perylene	ND	µg/L	10

*Trace concentrations detected below the reporting limit.

NA = Not applicable.

ND = Not detected.

Reported by _____ Approved by _____

PRIORITY POLLUTANT SEMIVOLATILE ORGANICS

EPA Method 625 + 625/HSL List

QUALITY CONTROL

Client Name: Haley & Aldrich, Inc. (Job No. 635401)

Client ID: Laboratory Control Spike

Laboratory ID: 6275-01BS

Matrix: Aqueous Sampled: NA Received: NA

Authorized: NA Prepared: 12/21/87 Analyzed: 01/11/88

Parameter	% Recovery	QC Advisory Limits
2-Chlorophenol	70	27 - 123%
Phenol	35	12 - 89%
4-Chloro-3-methylphenol	65	23 - 97%
4-Nitrophenol	18	10 - 80%
Pentachlorophenol	45	9 - 103%
1,4-Dichlorobenzene	65	36 - 97%
N-Nitroso-di-n-propylamine	72	41 - 116%
1,2,4-Trichlorobenzene	70	39 - 98%
Acenaphthene	83	46 - 118%
2,4-Dinitrotoluene	79	24 - 96%
Pyrene	96	26 - 127%

NA = Not applicable.

Reported by JC Approved by NCF

Enseco

PRIORITY POLLUTANT SEMIVOLATILE ORGANICS

EPA Method 625 + 625/HSL List

QUALITY CONTROL

Client Name: Haley & Aldrich, Inc. (Job No. 635401)

Client ID: Laboratory Control Spike Dup.

Laboratory ID: 6275-01BSD

Matrix: Aqueous Sampled: NA Received: NA

Authorized: NA Prepared: 12/21/87 Analyzed: 01/11/88

Parameter	% Recovery	QC Advisory Limits
2-Chlorophenol	66	27 - 123%
Phenol	35	12 - 89%
4-Chloro-3-methylphenol	58	23 - 97%
4-Nitrophenol	20	10 - 80%
Pentachlorophenol	41	9 - 103%
1,4-Dichlorobenzene	62	36 - 97%
N-Nitroso-di-n-propylamine	71	41 - 116%
1,2,4-Trichlorobenzene	63	39 - 98%
Acenaphthene	79	46 - 118%
2,4-Dinitrotoluene	77	24 - 96%
Pyrene	84	26 - 127%

NA = Not applicable.

Reported by LC Approved by NCR

SEMIVOLATILE ORGANICS

Surrogate Recovery Summary

Client Name: Haley & Aldrich, Inc. (Job No. 635401)

Matrix: Aqueous

Authorized: 01/04/88 Received: 01/04/88

		Surrogate Compound (%)					
Erco ID	Client ID	2-Fluoro-phenol	d_5-Phenol	2,4,6-Tribro-mophenol	d_5-Nitro-benzene	2-Fluoro-biphenyl	d_{14}-p-Terphenyl
6374-01	B100-OW	51	45	101	77	86	100
6374-04	B102-OW	38	34	87	87	89	98
6374-05	B100-OW	36	36	56	86	89	83
6374-05B	Erco Blank	39	28	101	86	93	101
6275-01BS	Laboratory Control Spike	53	42	65	78	72	77
6275-01BSD	Laboratory Control Spike Dup.	59	43	61	72	72	75
QC Advisory Limits:		21-100%	10-94%	35-114%	43-116%	33-114%	18-137%

Reported by NCR Approved by AVL

Enseco

PRIORITY POLLUTANT ORGANOCHLORINE PESTICIDES/PCBs

EPA Method 608

Client Name: Haley & Aldrich, Inc. (Job No. 635401)

Client ID: Erco Blank

Laboratory ID: 6378-15B

Matrix: Aqueous Sampled: NA Received: NA

Authorized: NA Prepared: 01/06/88 Analyzed: 01/15/88

Parameter	Result	Units	Reporting Limit
alpha-BHC	ND	µg/L	0.05
beta-BHC	ND	µg/L	0.05
delta-BHC	ND	µg/L	0.05
gamma-BHC (Lindane)	ND	µg/L	0.05
Heptachlor	ND	µg/L	0.05
Aldrin	ND	µg/L	0.05
Heptachlor epoxide	ND	µg/L	0.05
Endosulfan I	ND	µg/L	0.05
Dieldrin	ND	µg/L	0.10
4,4'-DDE	ND	µg/L	0.10
Endrin	ND	µg/L	0.10
Endosulfan II	ND	µg/L	0.10
4,4'-DDD	ND	µg/L	0.10
Endosulfan sulfate	ND	µg/L	0.10
4,4'-DDT	ND	µg/L	0.10
Endrin aldehyde	ND	µg/L	0.10
Methoxychlor	ND	µg/L	0.50
Chlordane	ND	µg/L	0.50
Toxaphene	ND	µg/L	1.0
Aroclor-1016	ND	µg/L	0.50
Aroclor-1221	ND	µg/L	0.50
Aroclor-1232	ND	µg/L	0.50
Aroclor-1242	ND	µg/L	0.50
Aroclor-1248	ND	µg/L	0.50
Aroclor-1254	ND	µg/L	0.50
Aroclor-1260	ND	µg/L	0.50

NA = Not applicable.

ND = Not detected.

Reported by JKD Approved by EK

Enseco

PRIORITY POLLUTANT VOLATILE ORGANICS

EPA Method 624 + 624/HSL List

QUALITY CONTROL

Client Name: Haley & Aldrich, Inc. (Job No. 635401)

Client ID: Laboratory Control Spike

Laboratory ID: 2660LCS

Matrix: Aqueous Prepared: 01/08/88 Analyzed: 01/08/88

Parameter	% Recovery	QC Advisory Limits
1,1-Dichloroethene	90	61 - 145%
Trichloroethene	91	71 - 120%
Benzene	88	76 - 127%
Toluene	88	76 - 125%
Chlorobenzene	90	75 - 130%

Reported by SA Approved by CB

Enseco

PRIORITY POLLUTANT VOLATILE ORGANICS

EPA Method 624 + 624/HSL List

QUALITY CONTROL

Client Name: Haley & Aldrich, Inc. (Job No. 635401)

Client ID: Laboratory Control Spike Dup.

Laboratory ID: 2669LCSD

Matrix: Aqueous Prepared: 01/08/88 Analyzed: 01/08/88

Parameter	% Recovery	QC Advisory Limits
1,1-Dichloroethene	100	61 - 145%
Trichloroethene	100	71 - 120%
Benzene	97	76 - 127%
Toluene	92	76 - 125%
Chlorobenzene	101	75 - 130%

Reported by SA Approved by

Enseco

VOLATILE ORGANICS

Surrogate Recovery Summary

Client Name: Haley & Aldrich, Inc. (Job No. 635401)

Matrix: Aqueous

Authorized: 01/04/88 Received: 01/04/88

		Surrogate Compound		
Erco ID	Client ID	d_4-1,2,-Dichloro-ethane	d_8-Toluene	p-Bromofluoro-benzene
6374-01	B100-OW	110	89	107
6374-03	B2-OW	105	91	101
6374-04	B102-OW	126	92	128
6374-05	B4-OW	103	92	103
QC Advisory Limits:		76-114%	88-110%	86-115%

Reported by SA Approved by

Enseco

METALS QC

Laboratory ID: Blank

Matrix: Aqueous | Received: With Box 255

Prepared: 01/11/88 | Analyzed: 01/14/88

Parameter	Result	Units	Reporting Limit	Analytical Method
Aluminum	ND	mg/L	0.05	200.7
Antimony	ND	mg/L	0.05	200.7
Arsenic	ND	mg/L	0.005	206.2
Barium	ND	mg/L	0.005	200.7
Beryllium	ND	mg/L	0.001	200.7
Cadmium	ND	mg/L	0.005	200.7
Calcium	ND	mg/L	0.1	200.7
Chromium	ND	mg/L	0.01	200.7
Cobalt	ND	mg/L	0.01	200.7
Copper	ND	mg/L	0.006	200.7
Iron	ND	mg/L	0.05	200.7
Lead	ND	mg/L	0.01	239.2
Magnesium	ND	mg/L	0.1	200.7
Manganese	ND	mg/L	0.005	200.7
Mercury	ND	mg/L	0.0002	245.1
Nickel	ND	mg/L	0.04	200.7
Potassium	ND	mg/L	5	200.7
Selenium	ND	mg/L	0.005	270.2
Silver	ND	mg/L	0.005	200.7
Sodium	ND	mg/L	0.5	200.7
Thallium	ND	mg/L	0.004	271.2
Tin	ND	mg/L	0.03	200.7
Vanadium	ND	mg/L	0.01	200.7
Zinc	ND	mg/L	0.01	200.7

ND = Not detected.

Reported by CM Approved by SDC

METALS QC

Laboratory ID: Laboratory Control Spike

Matrix: Aqueous Received: With Box 255

Prepared: 01/11/88 Analyzed: 01/14/88

Parameter	Spike Added	% Recovery	Units	Reporting Limit	Analytical Method
Aluminum	2.0	103	mg/L	0.05	200.7
Antimony	0.60	92	mg/L	0.05	200.7
Arsenic	0.020	110	mg/L	0.005	206.2
Barium	2.0	98	mg/L	0.005	200.7
Beryllium	0.050	94	mg/L	0.001	200.7
Cadmium	0.050	96	mg/L	0.005	200.7
Calcium	100	102	mg/L	0.1	200.7
Chromium	0.200	100	mg/L	0.01	200.7
Cobalt	0.500	98	mg/L	0.01	200.7
Copper	0.250	99	mg/L	0.006	200.7
Iron	1.0	115	mg/L	0.05	200.7
Lead	0.020	105	mg/L	0.01	239.2
Magnesium	50	102	mg/L	0.1	200.7
Manganese	0.200	95	mg/L	0.005	200.7
Mercury	0.0025	112	mg/L	0.0002	245.1
Nickel	0.400	99	mg/L	0.04	200.7
Potassium	50	96	mg/L	5	200.7
Selenium	0.010	99	mg/L	0.005	270.2
Silver	0.040	100	mg/L	0.005	200.7
Sodium	100	103	mg/L	0.5	200.7
Thallium	0.050	94	mg/L	0.004	271.2
Tin	0.400	94	mg/L	0.03	200.7
Vanadium	0.500	100	mg/L	0.01	200.7
Zinc	0.200	100	mg/L	0.01	200.7

Reported by CML Approved by SDC

Enseco

METALS QC

Laboratory ID: Laboratory Control Spike Dup.

Matrix: Aqueous Received: With Box 255

Prepared: 01/11/88 Analyzed: 01/14/88

Parameter	Spike Added	% Recovery	Units	Reporting Limit	Analytical Method
Aluminum	2.0	100	mg/L	0.05	200.7
Antimony	0.60	95	mg/L	0.05	200.7
Arsenic	0.020	120	mg/L	0.005	206.2
Barium	2.0	100	mg/L	0.005	200.7
Beryllium	0.050	96	mg/L	0.001	200.7
Cadmium	0.050	100	mg/L	0.005	200.7
Calcium	100	105	mg/L	0.1	200.7
Chromium	0.200	101	mg/L	0.01	200.7
Cobalt	0.500	92	mg/L	0.01	200.7
Copper	0.250	101	mg/L	0.006	200.7
Iron	1.0	100	mg/L	0.05	200.7
Lead	0.020	100	mg/L	0.01	239.2
Magnesium	50	104	mg/L	0.1	200.7
Manganese	0.200	96	mg/L	0.005	200.7
Mercury	0.0025	112	mg/L	0.0002	245.1
Nickel	0.400	101	mg/L	0.04	200.7
Potassium	50	100	mg/L	5	200.7
Selenium	0.010	110	mg/L	0.005	270.2
Silver	0.040	98	mg/L	0.005	200.7
Sodium	100	106	mg/L	0.5	200.7
Thallium	0.050	92	mg/L	0.004	271.2
Tin	0.400	93	mg/L	0.03	200.7
Vanadium	0.500	101	mg/L	0.01	200.7
Zinc	0.200	106	mg/L	0.01	200.7

Reported by CAK Approved by SDC

Enseco

PETROLEUM HYDROCARBON ANALYSIS BY IR

EPA Method 418.1

Client Name: Haley & Aldrich, Inc. (Job No. 635401)
Client ID: Erco Blank
Laboratory ID: 6374-05B
Matrix: Aqueous Sampled: NA Received: NA
Authorized: NA Prepared: 01/05/88 Analyzed: 01/07/88

Parameter	Result	Units	Reporting Limit
Petroleum hydrocarbon	ND	mg/L	0.5

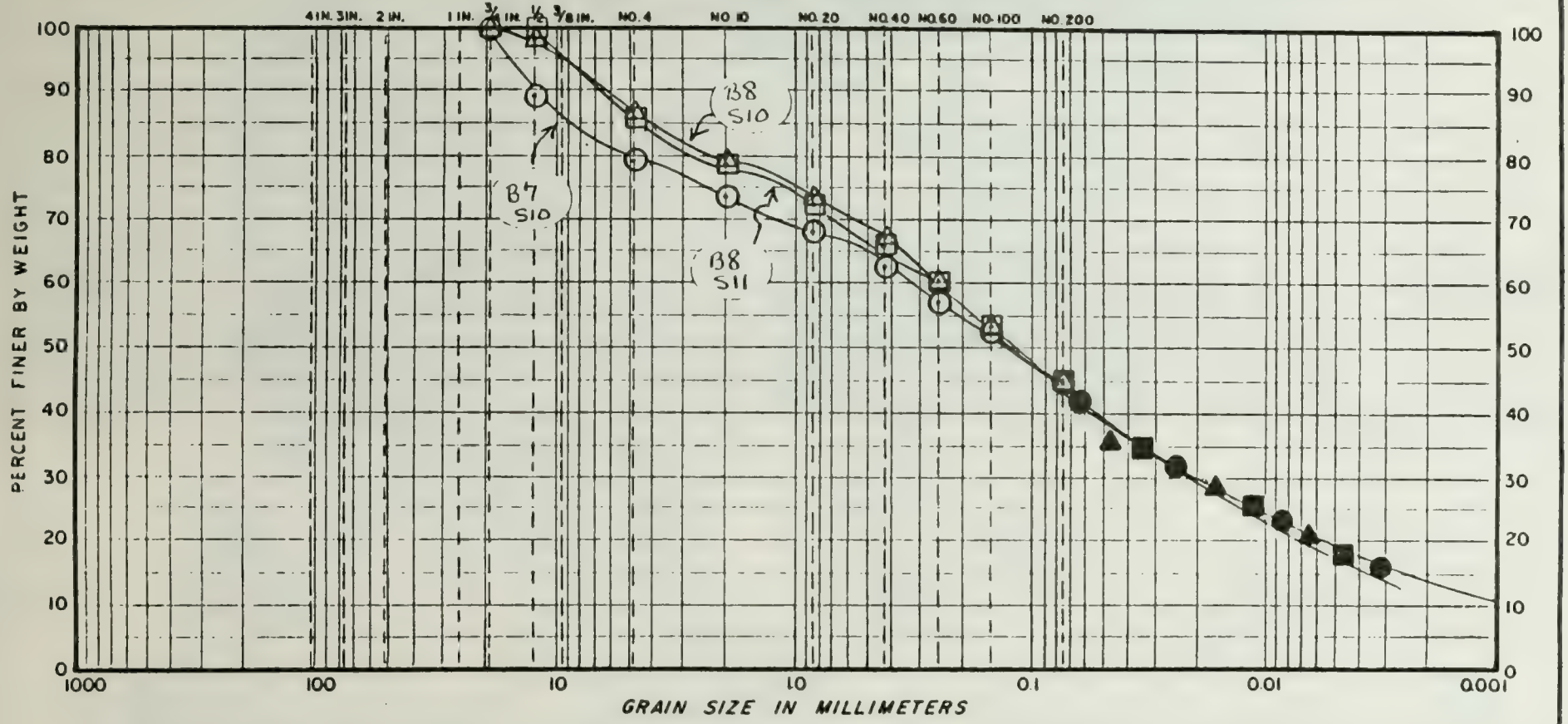
NA = Not applicable.
ND = Not detected.

Reported by AJ Approved by MEC

APPENDIX C

Laboratory Soil Test Data

GRAIN SIZE DISTRIBUTION



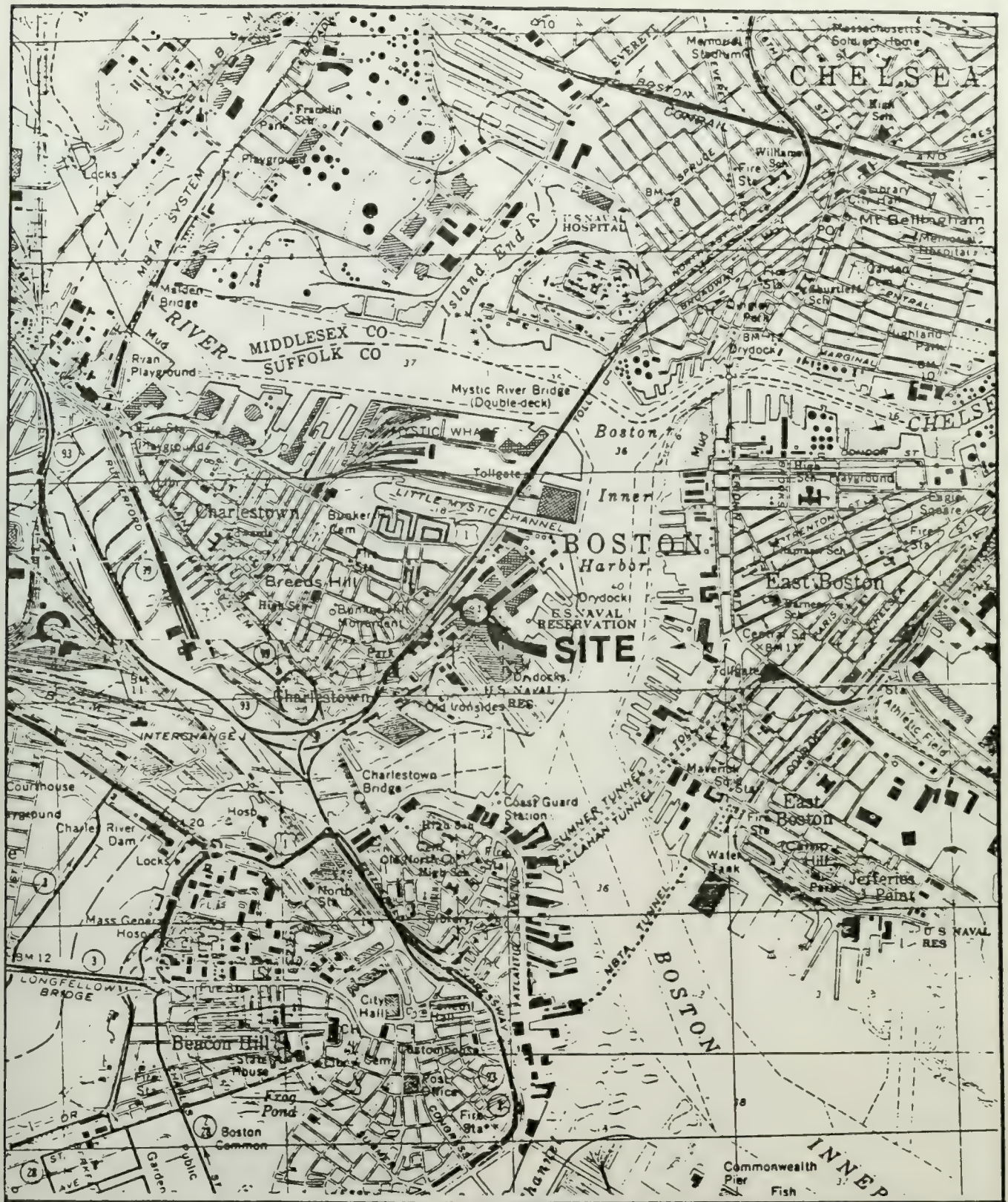
COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

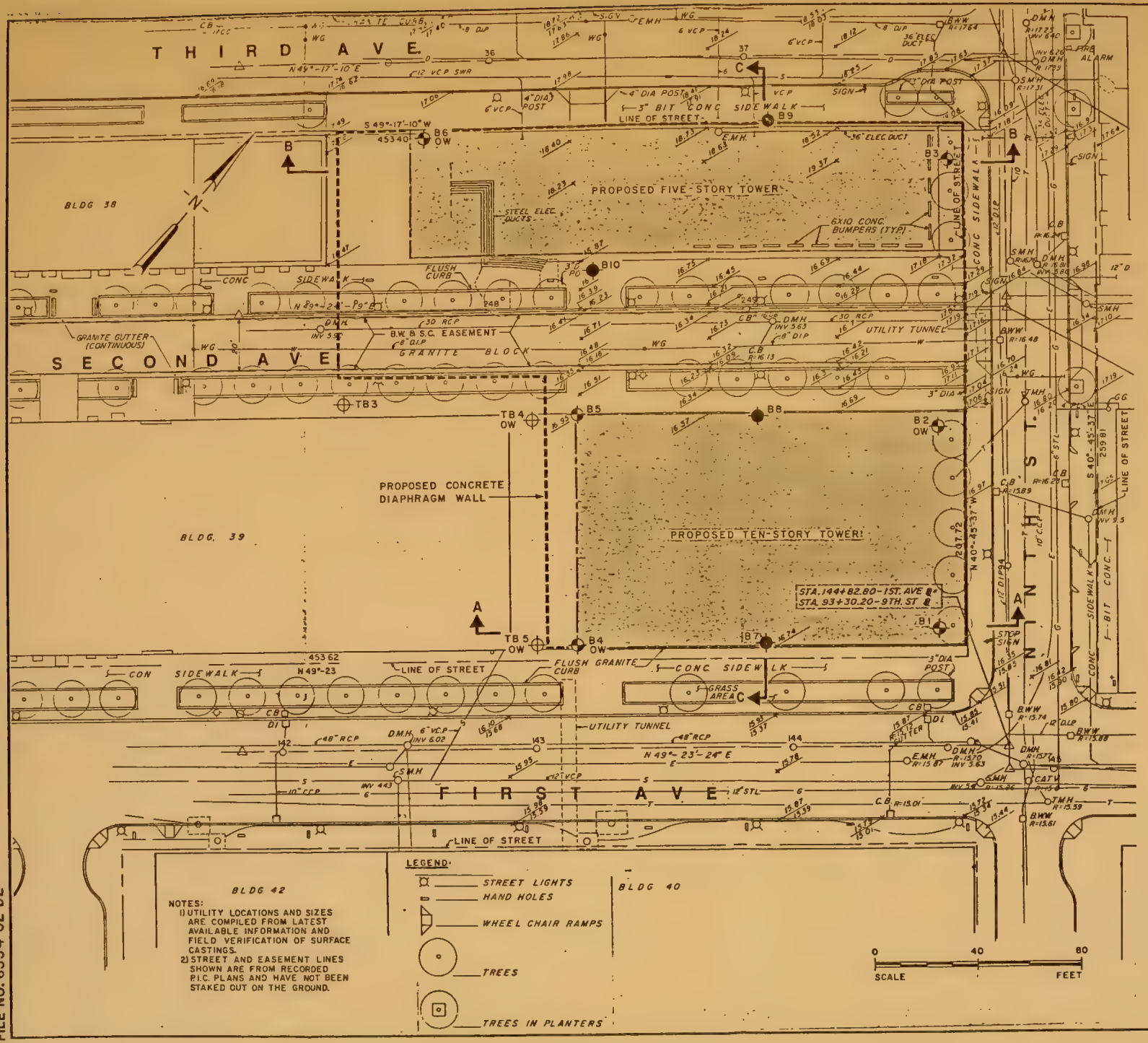
UNIFIED SOIL CLASSIFICATION SYSTEM, CORPS OF ENGINEERS, U.S. ARMY

Expl. No.	Sample No.	Depth(ft)	Description
B7	S10	35.0-37.0	Gray silty medium to fine SAND, some gravel, trace coarse sand
B8	S10	30.0-32.0	Gray silty medium to fine SAND, little gravel, trace coarse sand
B8	S11	35.0-37.0	Gray silty medium to fine SAND, little gravel, trace coarse sand

PROJECT PARCELS 39A & 150, CHARLESTOWN NAVY YARD, CHARLESTOWN, MA

FILE NO. 635402 DATE OCTOBER 1987


CHELSEA
Boston
Inner
BOSTON
Harbor
East Boston
Charlestown
Breeds Hill
SITE
E.S. NAVAL RESERVATION
RIVER
MIDDLESEX CO
SUFFOLK CO
Mystic River Bridge
(Double-deck)
Island End R
Charlestown Bridge
Coast Guard Station
SUMNER TUNNEL
CALLAHAN TUNNEL
MBTA TUNNEL
BOSTON
INNER
Beacon Hill
Frog Pond
Boston Common
Commonwealth Pier
Fish
LONGFELLOW BRIDGE
INTERCHANGE
Charles River Dam
Mass General Hosp
Courthouse
Jeffries Point
U S NAVAL RES
Mt Bellingham
Navy Yard
Locks
Ryan Playground
Franklin Park
Playground
Tollgate
Little Mystic Channel
Orydocks
U.S. NAVAL
Old Ironsides
Athletic Field
Water Tank
City Hall
Post Office
North St
Fire Sta
High Sch
Library
Hospital
Garden
Public
Marginal
Broadway
Sprague
Eagle Square
Maverick Sq
Central Sq
Paris St
Meridian St
Bunker Hill Monument
Old North Church
Faneuil Hall
Boston Globe
State House
Boston Garden
Boston Herald
Traveler
Mystic Wharf
Toll
Mud
Flats
Marsh
Boston & Maine R.R.
Conrail
MBTA SYSTEM
Malden Bridge
Locks
Playground
Fire Sta
Library
City Hall
Mt Bellingham
Navy Yard
Hospital
Garden
Central
Courtlett Sch
Highland Park



NOTES:
1) UTILITY LOCATIONS AND SIZES ARE COMPILED FROM LATEST AVAILABLE INFORMATION AND FIELD VERIFICATION OF SURFACE CASTINGS.
2) STREET AND EASEMENT LINES SHOWN ARE FROM RECORDED P.I.C. PLANS AND HAVE NOT BEEN STAKED OUT ON THE GROUND.

LEGEND

- B-1 — LOCATION AND DESIGNATION OF TEST BORING CONDUCTED FOR PROPOSED SITE DEVELOPMENT DURING APRIL - JUNE 1987 (SEE NOTE 2)
- B-7 — LOCATION AND DESIGNATION OF TEST BORING CONDUCTED FOR PROPOSED SITE DEVELOPMENT DURING JUNE 1987 (SEE NOTE 3)
- TB-5 — LOCATION AND DESIGNATION OF TEST BORING CONDUCTED FOR ADJACENT FOUNDATION UNDERPINNING DURING JANUARY - FEBRUARY 1987 (SEE NOTE 4)
- (OW) — INDICATES GROUNDWATER OBSERVATION WELL INSTALLED IN THE COMPLETED BORE HOLE
- APPROXIMATE LOCATION, PROPOSED SLURRY WALL
- A A — LOCATION, DESIGNATION AND ORIENTATION OF SUBSURFACE PROFILE

NOTES

1. CYGNA CONSULTING ENGINEERS DRAWING "PRELIMINARY SITE PLAN", NO. C-1, JOB NO. 87144 WAS USED AS BASE PLAN IN PREPARATION OF THIS FIGURE.
2. TEST BORINGS WERE CONDUCTED BY JOHN J. BOYLE, MILTON, MASSACHUSETTS, AND MONITORED BY HALEY & ALDRICH, INC.
3. TEST BORINGS WERE CONDUCTED BY CARR-DEE CORP., MEDFORD, MASSACHUSETTS, AND MONITORED BY HALEY & ALDRICH, INC.
4. TEST BORINGS WERE CONDUCTED BY BRIGGS ASSOC., INC., ROCKLAND, MASSACHUSETTS.

Haley & Aldrich, Inc.
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

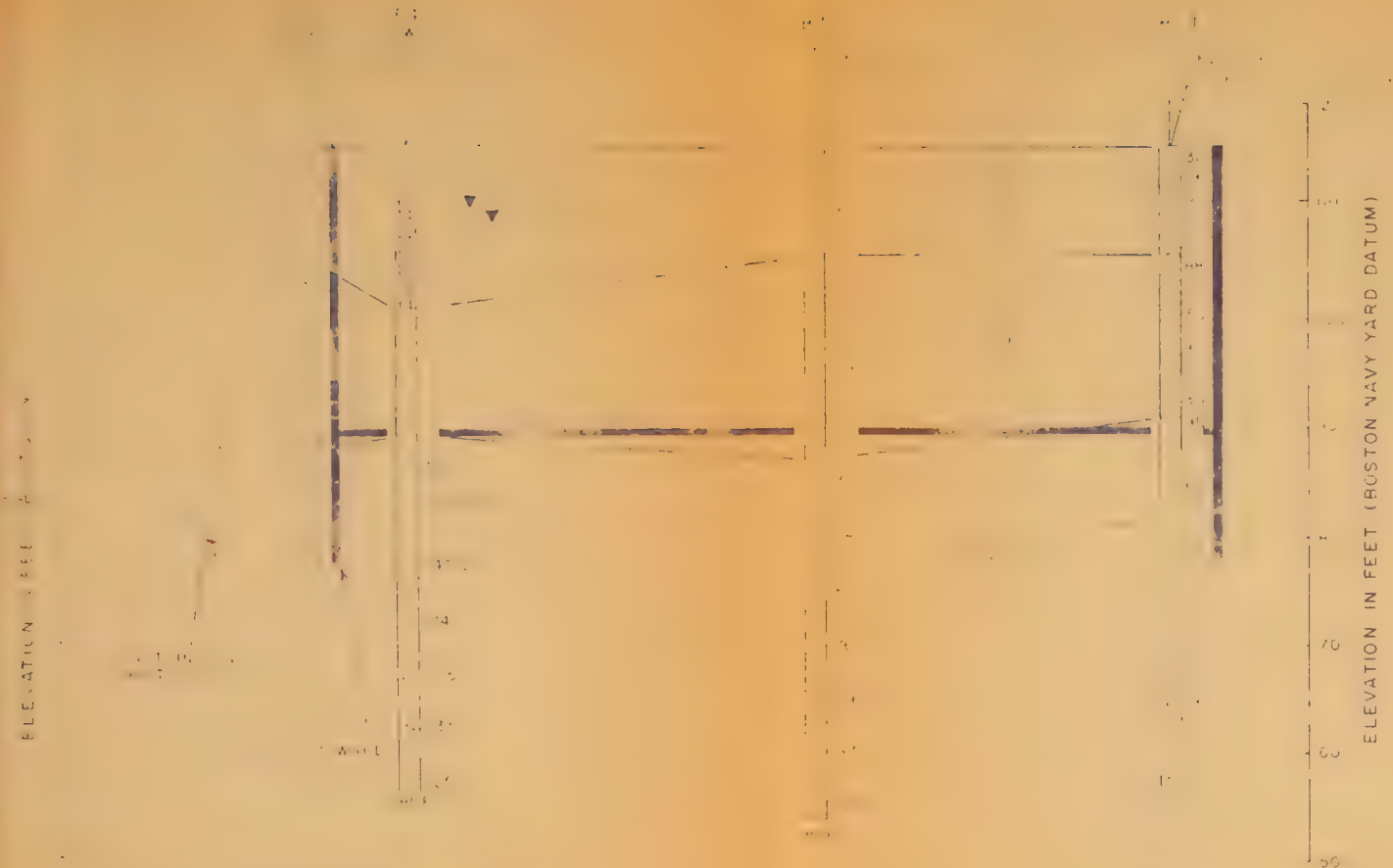
PARCELS 39A & 150
BOSTON NAVY YARD
CHARLESTOWN, MASSACHUSETTS

SUBSURFACE EXPLORATION LOCATION PLAN

SCALE: AS SHOWN — OCTOBER 1987

FILE NO. 6354-02-02

FIGURE 2



BORING LEGEND

- (B7) — DENOTES NUMBER AND LOCATION OF TEST BORING
- OW — OBSERVATION WELL
- EL. 5 / 5.5 FT — GROUND SURFACE ELEVATION / OFFSET FROM SECTION LINE
- STRATA CHANGE
- GROUNDWATER LEVEL IN BORING AT COMPLETION
- GROUNDWATER LEVEL IN OBSERVATION WELL ON THE INDICATED DATE
- 31 — STANDARD PENETRATION TEST RESULT IN BLOWS PER FOOT
- BOE — BOTTOM OF EXPLORATION

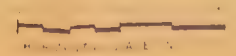
GEOLOGIC LEGEND

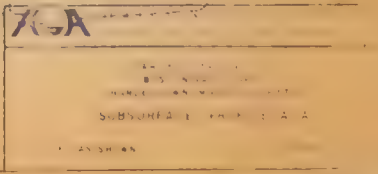
- (A) FILL — BROWN, LOOSE TO DENSE SILTY SAND TO SANDY SILT WITH TRACE AMOUNTS OF GRAVEL, BRICK, WOOD
- (B) CLAY — GRAY GREEN TO YELLOW BROWN, STIFF TO VERY STIFF SILTY CLAY WITH TRACE AMOUNTS OF SAND (GRAVEL)
- (C) TILL — BLUE GRAY, DENSE TO VERY DENSE, MEDIUM TO FINE SANDY CLAY TO SILTY SAND WITH VARYING AMOUNTS OF GRAVEL, COARSE SAND

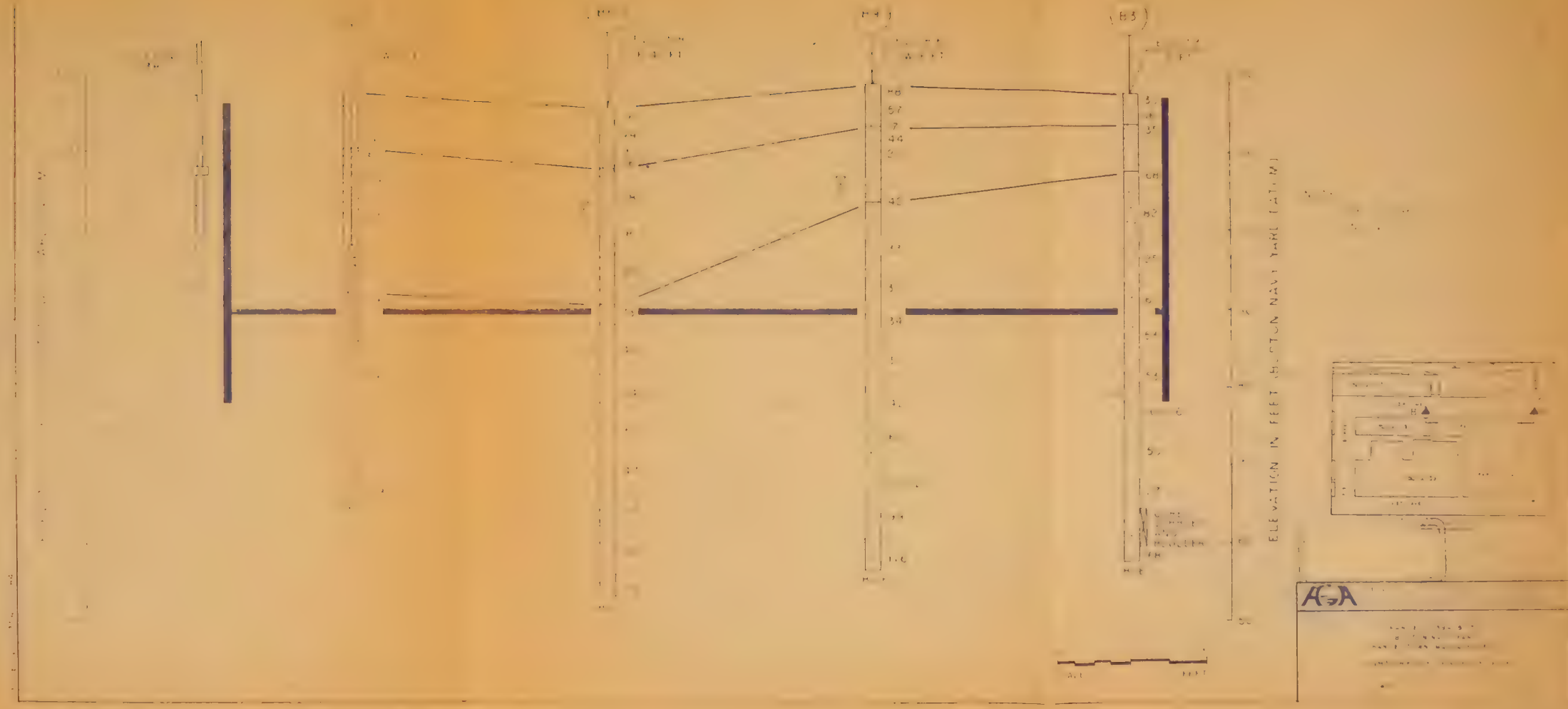
NOTES

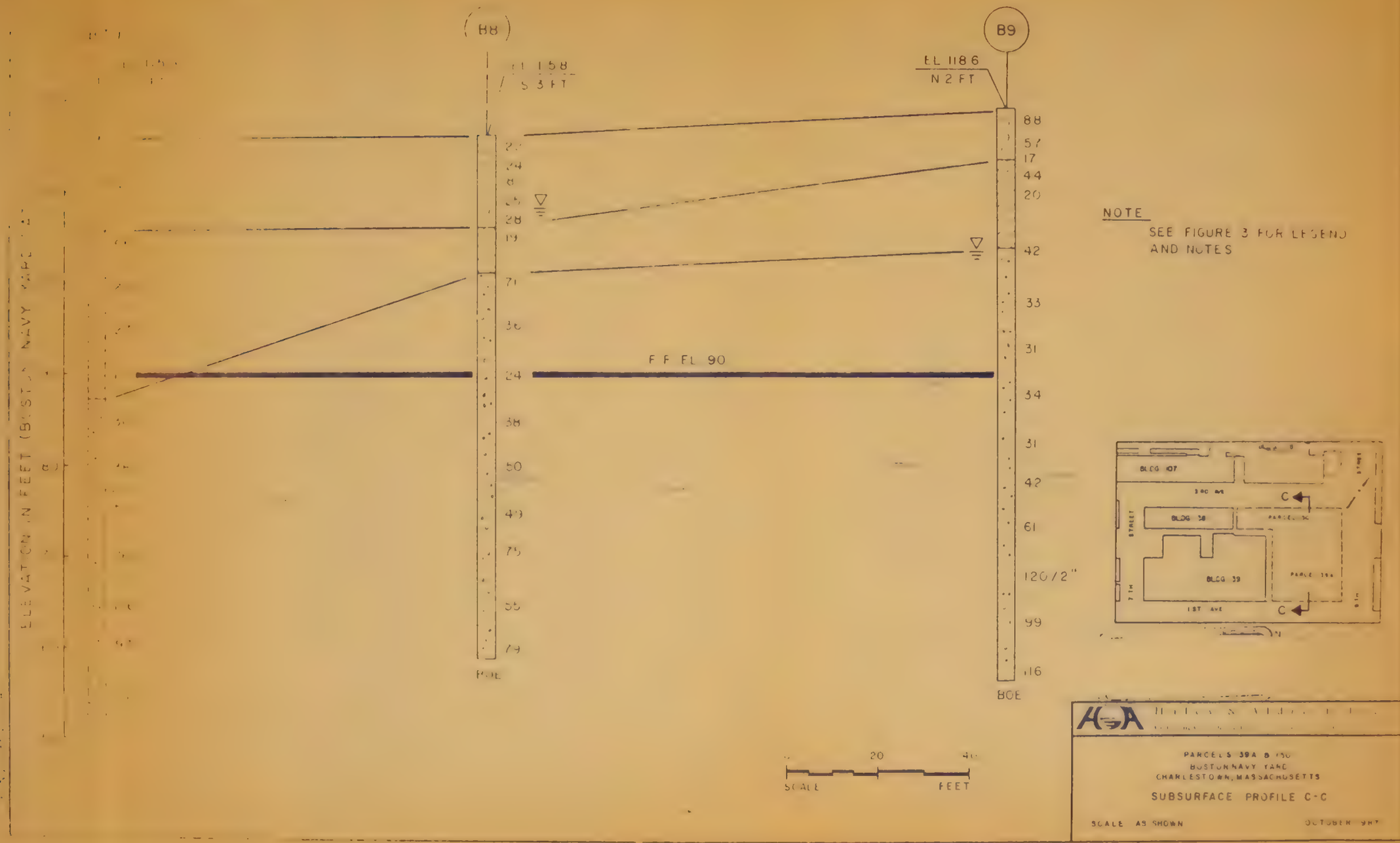
1. ELEVATIONS REFER TO BOSTON NAVY YARD DATUM.
2. LOCATIONS AND ORIENTATIONS OF SECTIONS AND PROFILES ARE INDICATED ON FIGURE 2.
3. SUBSURFACE STRATIFICATION LINES AND BOUNDARIES BETWEEN BORINGS ARE INTERPOLATED FROM AVAILABLE INFORMATION AND MAY VARY FROM ACTUAL FIELD CONDITIONS.
4. RELATIVE LOCATIONS OF EXISTING STRUCTURES FALLING ON PROFILE LINES HAVE BEEN SHIFTED PERPENDICULAR TO THE PROFILE FOR ILLUSTRATIVE PURPOSES. IN ADDITION, GROUND SURFACE ELEVATIONS AND SUBSURFACE BOUNDARIES BETWEEN THE PROFILE LINE MAY DIFFER FROM FIELD CONDITIONS.
5. FOUNDATION CONSIDERATIONS FOR BUILDING 77 (BUILDING 3 ON DRAWING 2016) ARE DISCUSSED IN DRAWING DATED 19 JUNE 1987.
6. FOUNDATION CONSIDERATIONS FOR BUILDING 78 FROM VALLEY & ALDRICH PRELIMINARY INVESTIGATIVE REPORT DATED JULY 1987 AND FOUNDATION DESIGN MEMORANDUM DATED 8 JANUARY 1988.





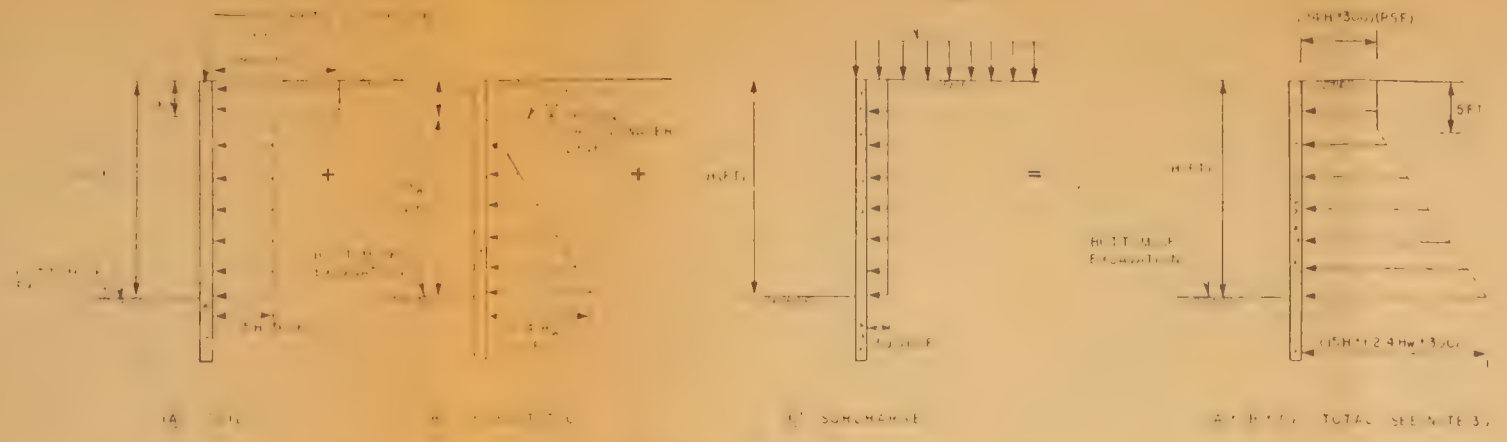



ELEVATION IN FEET (U.S.C.&G.S. MEAN TIDE DATUM)


B8
B9
EL 1158
S 3 FT
EL 1186
N 2 FT
88
57
17
44
20
42
33
31
34
31
42
61
120/2"
99
116
28
19
71
36
24
38
50
49
75
55
79
F F EL 90
BOE
BOE
ELEVATION IN FEET (BOSTON NAVY YARD DATUM)
NOTE
SEE FIGURE 3 FOR LEGEND AND NOTES
BLDG 107
BLDG 38
BLDG 39
C
C
1ST AVE
SCALE
20
FEET
PARCELS 39A & 150
BOSTON NAVY YARD
CHARLESTOWN, MASSACHUSETTS
SUBSURFACE PROFILE C-C
SCALE AS SHOWN
OCTOBER 1987

MINIMUM DESIGN LATERAL PRESSURES FOR CONCRETE DIAPHRAGM WALL

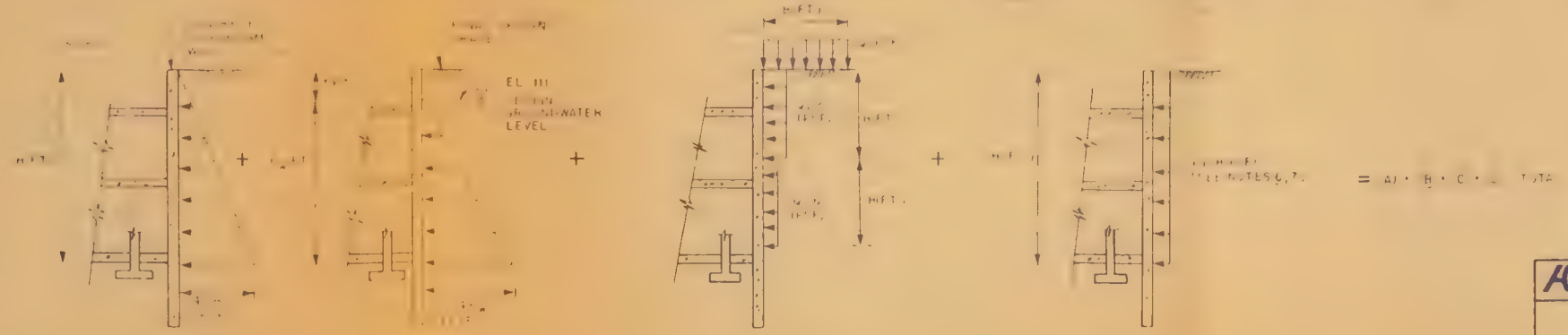
[illegible] TEMPORARY LATERAL SUPPORT (SEE NOTES 1 & 2)

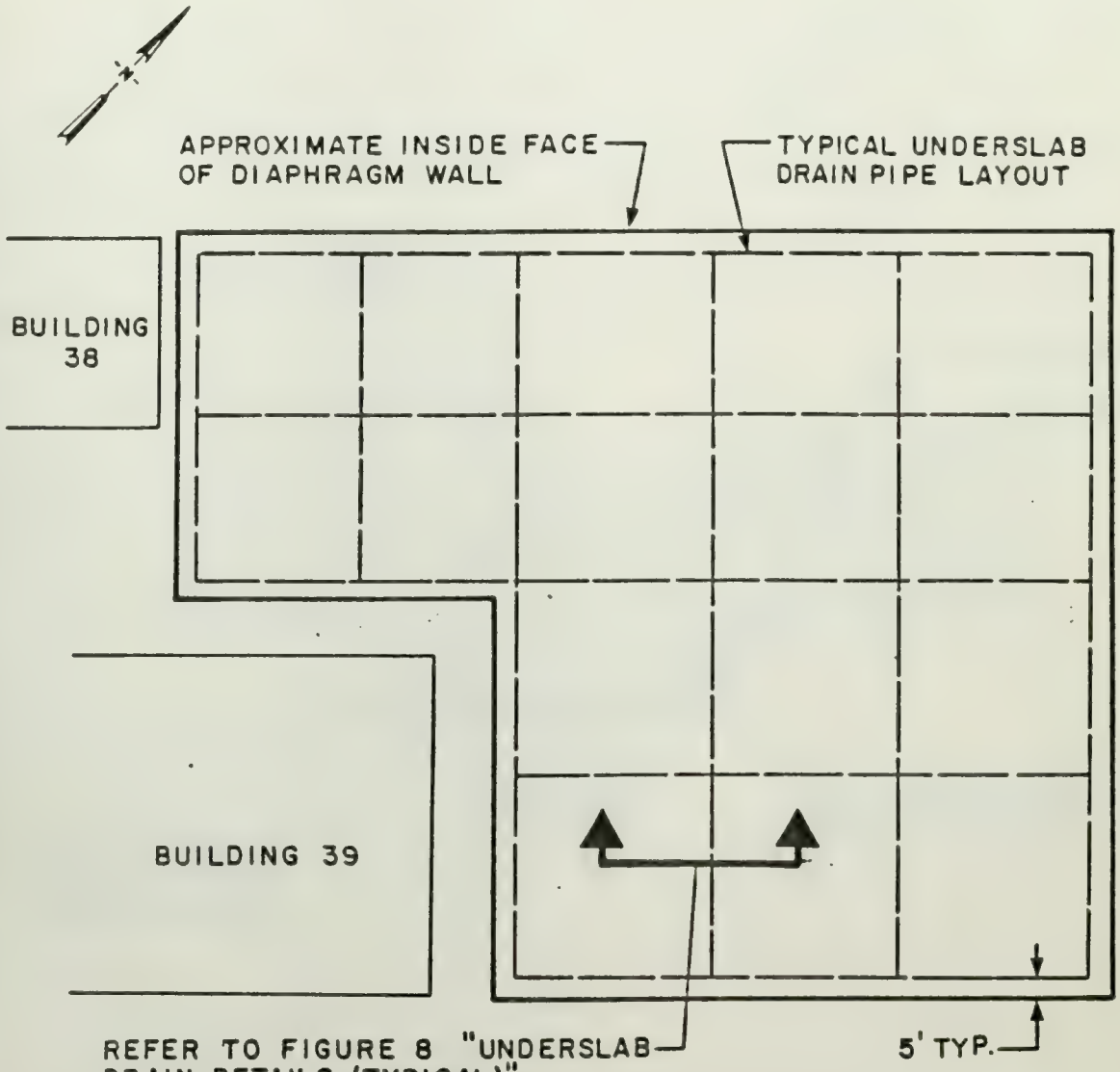


(A) [illegible] (B) [illegible] (C) SURCHARGE (D) [illegible] TOTAL SEE NOTE 3.

POST-CONSTRUCTION PERIOD

[illegible] PERMANENT LATERAL SUPPORT (SEE NOTES 2 & 5)


EL 111
H FT.
H FT.
H FT.



NOTES:

1. 50FT. CENTER TO CENTER SPACING FOR UNDERSLAB DRAIN PIPE, TYPICAL
2. FINAL LAYOUT OF UNDERSLAB DRAIN PIPE MAY VARY TO AVOID COLUMN FOOTINGS AND OTHER OBSTRUCTIONS.

DRAFT

0 50 100
SCALE FEET

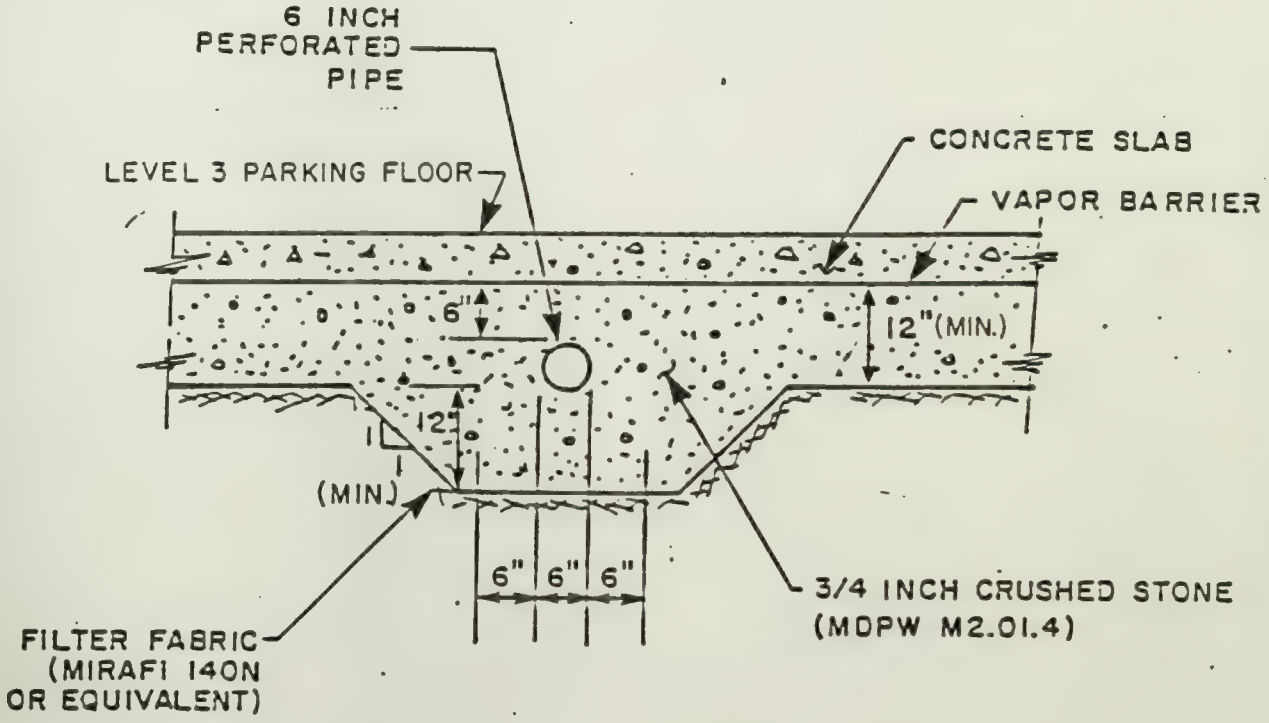
Haley & Aldrich, Inc.
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

PARCELS 39A & 150
BOSTON NAVY YARD
CHARLESTOWN, MASSACHUSETTS

TYPICAL UNDERSLAB DRAINAGE LAYOUT

SCALE: AS SHOWN OCTOBER 1987

FILE NO. 6354 02 A8



DRAFT

Haley & Aldrich, Inc.
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

PARCELS 39A & 150
BOSTON NAVY YARD
CHARLESTOWN, MASSACHUSETTS

UNDERSLAB DRAIN DETAILS (TYPICAL)

NOT TO SCALE

OCTOBER 1987

FILE NO. 6354 02 A6

4.0 Project Energy and Utility Requests

CYGNA
CONSULTING ENGINEERS
286 Congress Street, Boston, MA 02210 617/338-4500

January 18, 1989 389002-007

Boston Edison Company
843 Hyde Park Avenue
Hyde Park, MA 02136

Attention: Mr. Thomas Coyne

Subject: Jamestown Place Project, Parcel 39A
Charlestown Navy Yard, Boston

Dear Mr. Coyne:

On behalf of Kendall Development Corporation, Inc., Boston, MA this letter is to serve as an initial request for electric power service for the Jamestown Place Development project.

The project consists of a 9-story commercial office building 100,000 SF with a 3-story underground parking structure 50,000 SF.

The estimated connected electrical loads for the project are as follows:

Load Analysis

Area	Sq.Ft.	Watts/Sq.Ft.	Power (KW)
Garage 3 Levels	50,000	2	100
1st Fl. Retail/Commercial	14,000	15	210
2nd Fl. Commercial	13,505	12	162.06
3rd Fl. Commercial	14,415	12	172.98
4th Fl. Commercial	14,415	12	172.98
5th Fl. Commercial	14,415	12	172.98
6th Fl. Commercial	12,320	12	147.84
7th Fl. Commercial	9,150	12	109.80
8th Fl. Commercial	6,640	12	79.68
9th Fl. Commercial	665	11	7.98
		Total Estimated Power	1336.3

I @ 480V, 3-phase = 1607.36
Continuous Service X 1.25 = 2009.20

Power Distribution

A 2000 A, 480V, 3-phase service will be installed for the building. Power will be distributed from the main switchboard to floors two to nine via a bus duct system. Power to the retail space and garage will be distributed via conduit and wire.

CYGNA
CONSULTING ENGINEERS

Metering

Primary metering will be designed with an option of secondary metering at each floor.

Emergency Power

Elevator	25 HP
Fire Pump	75 HP
Smoke Exhaust	50 HP
Emergency Lights	20 KW
Fire Alarm	5 KW

Preliminary Sizing 275 KW Diesel Generator

The attached series of drawings are being provided to describe our project in detail.

Potential system tie-in and transformer locations are being evaluated as part of our design development phase efforts currently underway.

After you have had a chance to review this information, I would appreciate a meeting to discuss Boston Edison's design requirements, coordinate proposed tie-in locations, and begin the application process for a new service installation.

If you have any questions or would like to arrange a meeting, please do not hesitate to call me. I look forward to working with you and your staff.

Sincerely,

Joseph J. Gavegnano
Manager of projects

lec
Enc.

cc: Kendall Development
Donnelly & Maugel
Project File

CYGNA
CONSULTING
ENGINEERS
286 Congress Street, Boston, MA 02210
617/338-4500

January 11, 1989 389002-006

Boston Gas Company
201 Rivermore Street
West Roxbury, MA 03132

Attention: Mr. Ed O'Gara

Subject: Jamestown Place Project, Parcel 39A
Charlestown Navy Yard, Boston

Dear Mr. O'Gara:

On behalf of Kendall Development Corporation, Inc., Boston, MA this letter is to serve as an initial request for natural gas service for the Jamestown Place Development project.

The project consists of a 9-story commercial office building 100,000 SF with a 3-story underground parking structure 50,000 SF.

The project will be heated and air conditioned using a vertical heat pump fan coil system.

A gas-fired boiler will be installed on the first parking level. I have provided two copies of a building location/site plan showing a proposed master meter location. Total estimated gas load is 6,000 CFH. Additional drawings are enclosed to further describe the project.

Construction is scheduled for May of 1989. Kendall Development Corporation, 4 Longfellow Place, Boston, MA will be contracting the service installation.

We would appreciate your preliminary estimate for the work involved with the service installation and an estimated schedule so we can include it in the overall construction schedule.

If you have any specific requirements or need additional information, do not hesitate to call me.

Sincerely,

Joseph J. Gavegnano
Manager of projects

lec
Enc.

cc: Kendall Development
Donnelly & Maugel
Project File

CYGNA
CONSULTING ENGINEERS
296 Congress Street, Boston, MA 02210 617/338-4500

January 17, 1989 389002-007

Boston Water and Sewer Commission
425 Summer Street
Boston, MA 02210

Attention: Mr. Michael O'Neil

Subject: Jamestown Place Project, Parcel 39A
Charlestown Navy Yard, Boston

Dear Mr. O'Neil:

On behalf of Kendall Development Corporation, Inc., Boston, MA, this letter is to serve as an initial request for domestic water, sanitary sewer, and storm drainage services for the Jamestown Place development project.

The project consists of a 9-story commercial office building 100,000 SF with a 3-story underground parking structure 50,000 SF.

The estimated system demand volumes, based on 310 CMR 15.00 of the State Environmental Code Title 5 are as follows:

Domestic Water	3,750 Gallons Per Day
Sanitary Sewer	7,500 Gallons Per Day
Storm Drainage	Effective Roof Area approximately 15,000 SF

The attached series of drawings are being provided to describe the project. We are currently working on the design development phase and expect to have completed construction drawings and specifications out for bid at the end of May 1989.

Potential system connection locations are being evaluated by Cygna. When they become firm, I would like to arrange a meeting to coordinate final locations. In the meantime, if there are specific requirement which need to be satisfied, I would appreciate a copy at your earliest convenience.

I look forward to working with you and your staff. If you have any questions, do not hesitate to call me.

Thank you for your cooperation.

Sincerely,

Joseph J. Gavegnano
Manager of projects

lec
Enc.

cc: Kendall Development
Donnelly & Mauger
Project File

CYGNA
CONSULTING
ENGINEERS
286 Congress Street, Boston, MA 02210
617/338-4500

January 18, 1989 389002-008

New England Telephone Company
425 Summer Street
South Boston, MA 02210

Attention: Mr. Robert Kelly
Building Industry Consultants Service (BICS)

Subject: Jamestown Place Project, Parcel 39A
Charlestown Navy Yard, Boston

Dear Mr. Kelly:

On behalf of Kendall Development Corporation, Inc., Boston, MA, this letter is to serve as an initial request for telephone services for the Jamestown Place Development project.

Located on Parcel 39A at the corner of First Avenue and Ninth Street at the Charlestown Navy Yard, Jamestown Place consists of a nine-story commercial office building 100,000 SF and a three-story underground parking structure.

The attached series of drawings are being provided to describe the project in detail.

After you have had a chance to review this information, I would appreciate a meeting to discuss your design requirements, system tie-in locations, available network interface systems, and begin the application process for a new service installation.

If you have any questions or would like to schedule a meeting, please do not hesitate to call me.

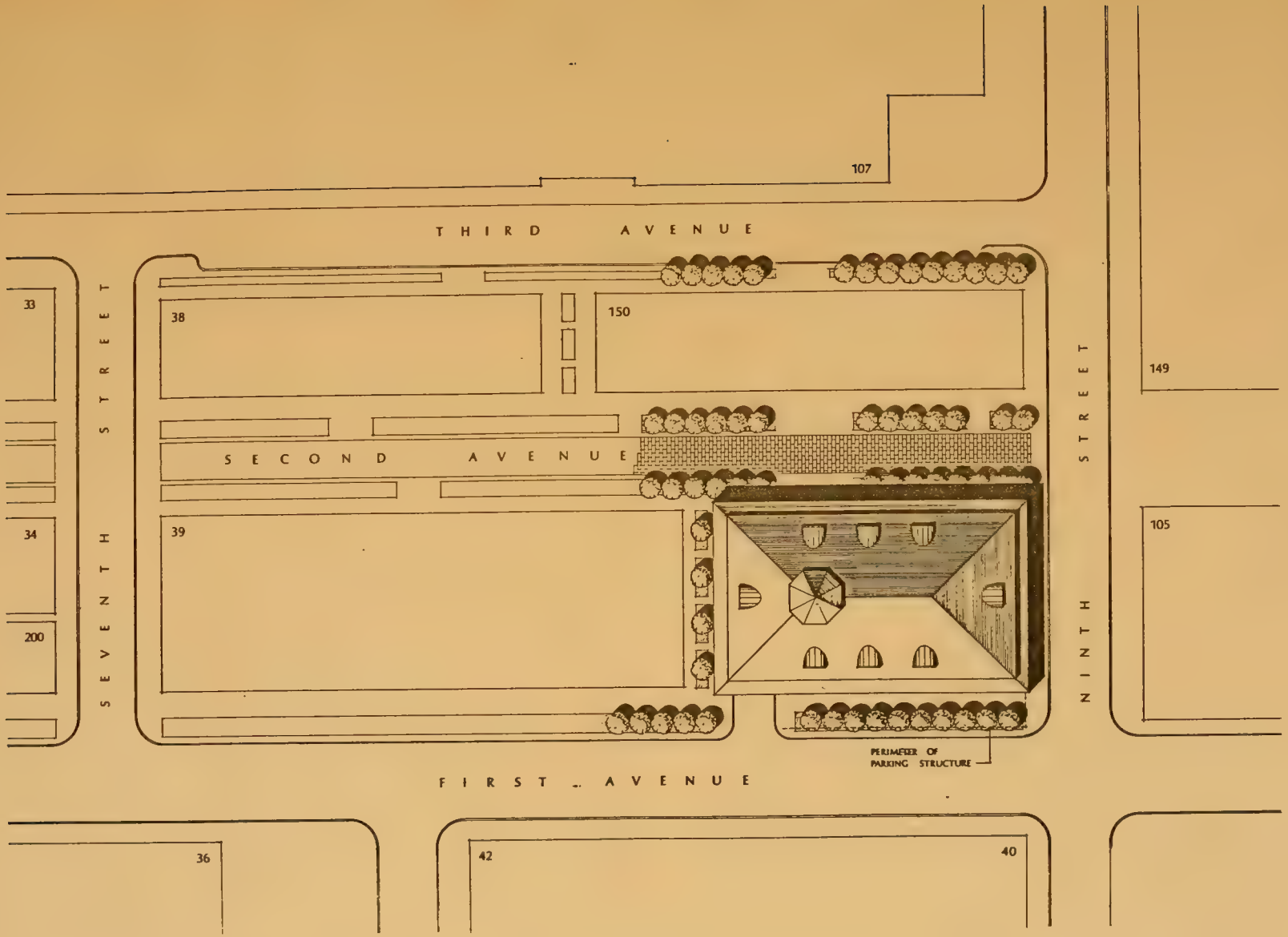
Sincerely,

Joseph J. Gavegnano
Manager of projects

lec
Enc.

cc: Kendall Development
Donnelly & Maugel
Project File

1.0 Architectural Design Drawings



SITE PLAN

DONNELLY MAUGEL ARCHITECTS

CYGNA CONSULTING ENGINEERS

JAMESTOWN PLACE, PARCEL 39A

Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust

Title SITE PLAN

Date

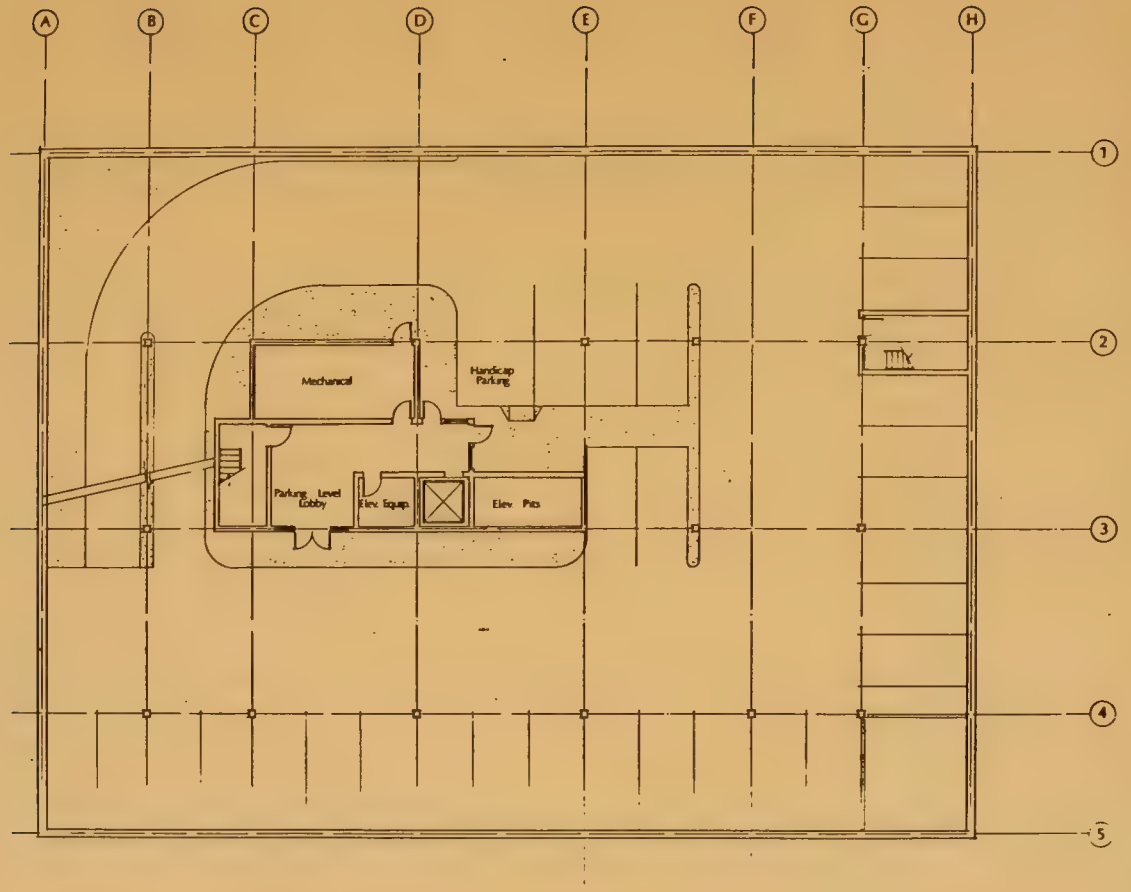
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By

Revised

Sht. No.

A1



PARKING LEVEL ONE

DONNELLY MAUGEL ARCHITECTS

CYGNA CONSULTING ENGINEERS

JAMESTOWN PLACE, PARCEL 39A

Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust

Title

Date

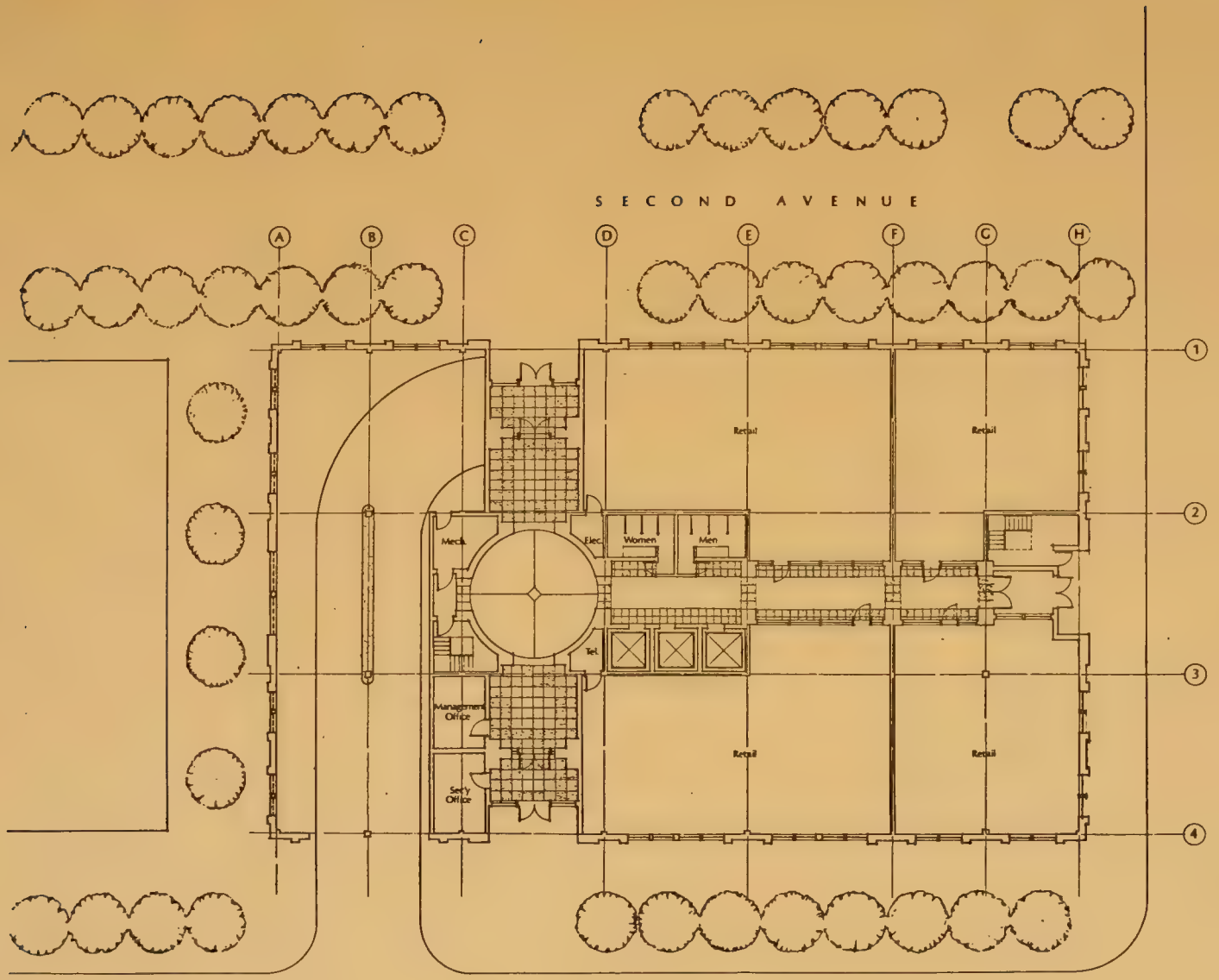
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By

Revised

Sht. No.

A2



FIRST FLOOR PLAN

DONNELLY MAUGEL ARCHITECTS

CYGNA CONSULTING ENGINEERS

JAMESTOWN PLACE, PARCEL 39A

Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust

Title

Date

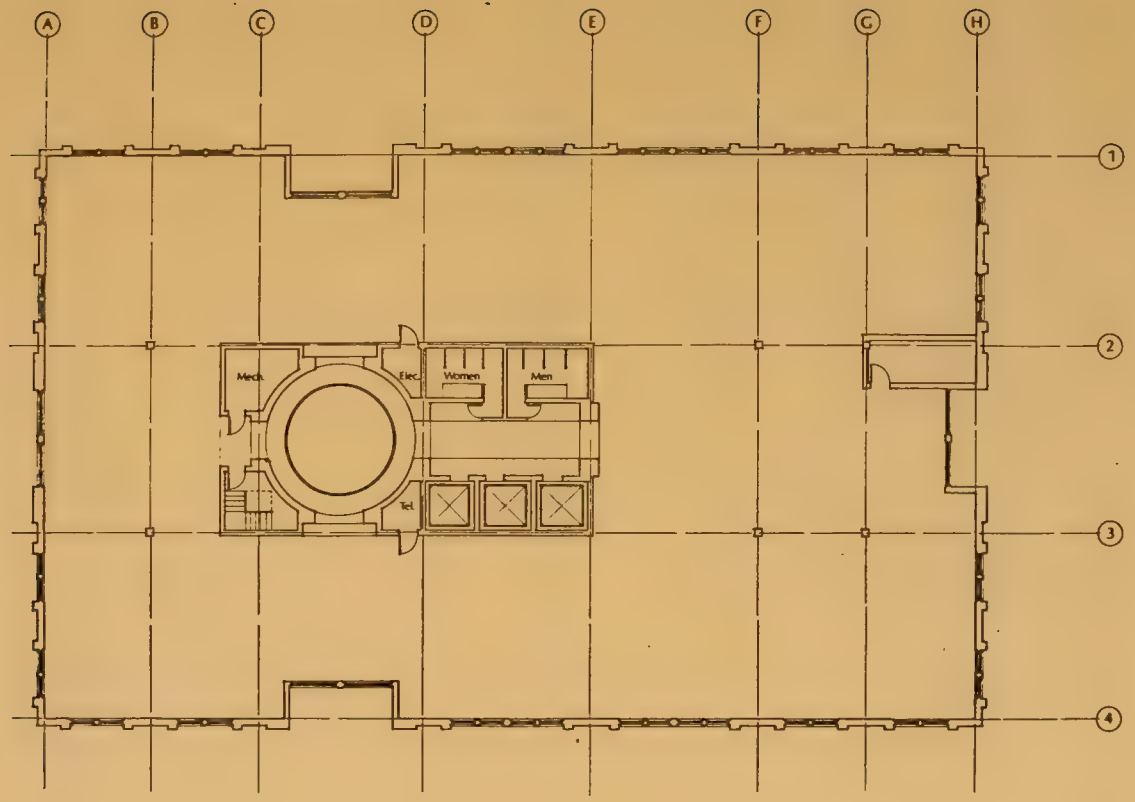
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By

Revised

Sht. No.

A3



SECOND FLOOR PLAN

DONNELLY MAUGEL ARCHITECTS

CYGNA CONSULTING ENGINEERS

JAMESTOWN PLACE, PARCEL 39A

Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust

Title SECOND FLOOR PLAN

Date

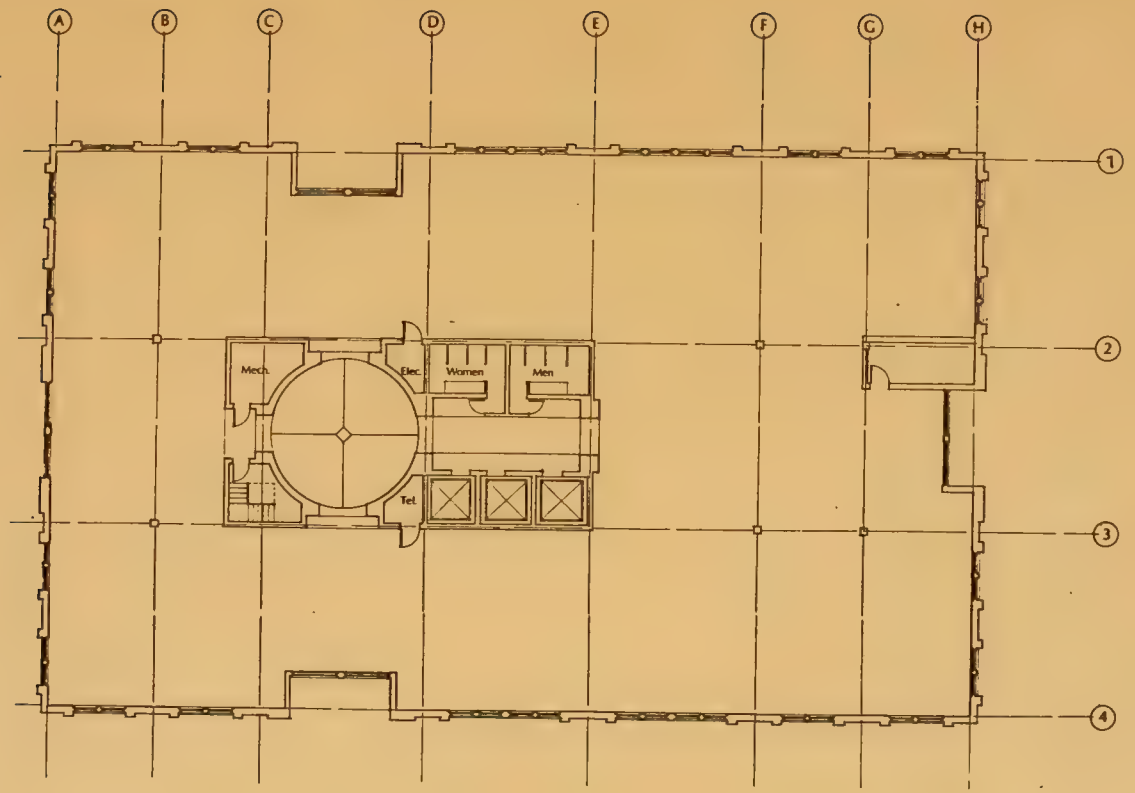
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Revised

Sht. No.

A4



THIRD FLOOR PLAN

DONNELLY MAUGEL ARCHITECTS

CYGNA CONSULTING ENGINEERS

JAMESTOWN PLACE, PARCEL 39A

Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust

Title

Date

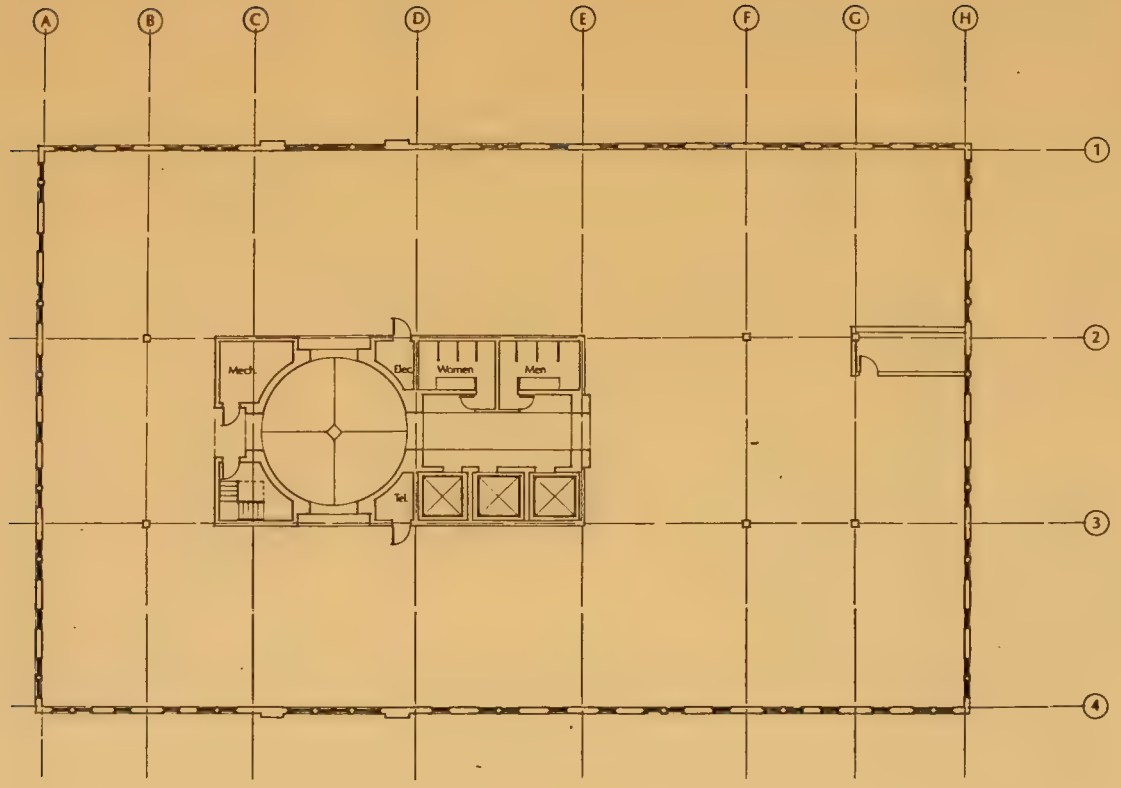
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Revised

Sht. No.

A5



4TH & 5TH FLOOR PLAN

DONNELLY MAUGEL ARCHITECTS

CYGNA CONSULTING ENGINEERS

JAMESTOWN PLACE, PARCEL 39A

Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust

Title

Date

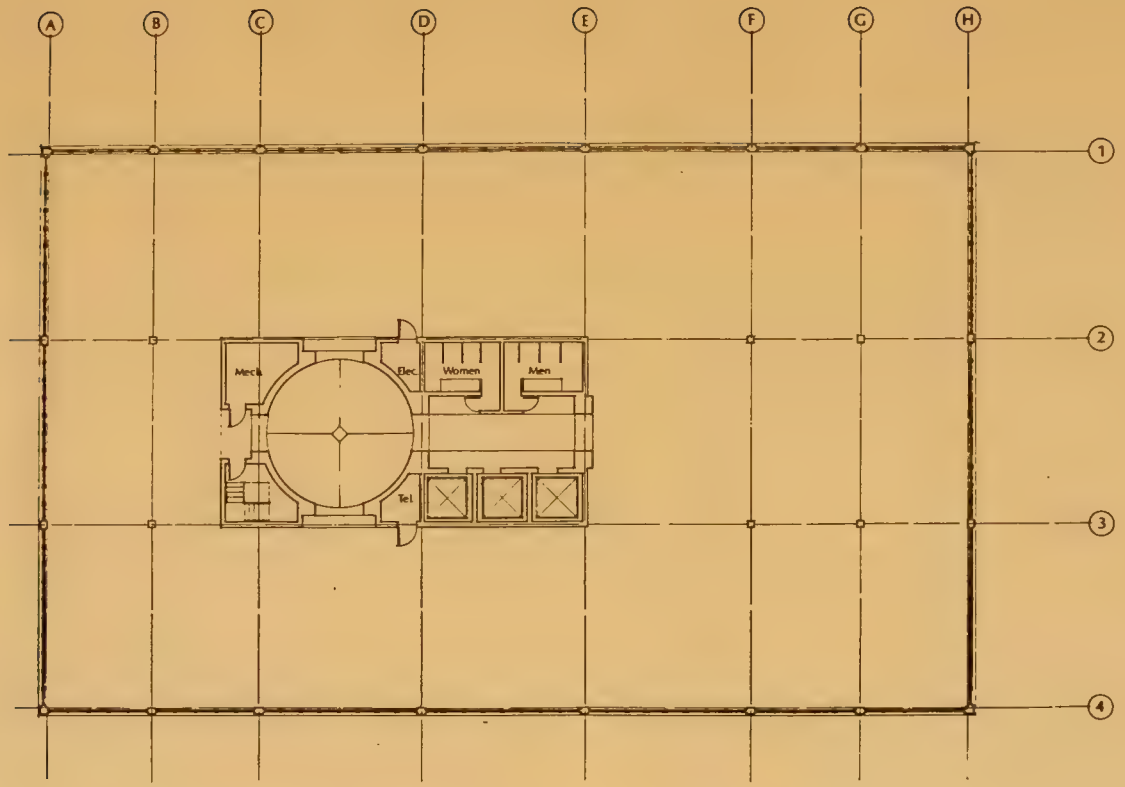
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Revised

Sht. No.

A6



SIXTH FLOOR PLAN

DONNELLY MAUGEL ARCHITECTS

CYGNA CONSULTING ENGINEERS

JAMESTOWN PLACE, PARCEL 39A

Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust

Title SIXTH FLOOR PLAN

Date

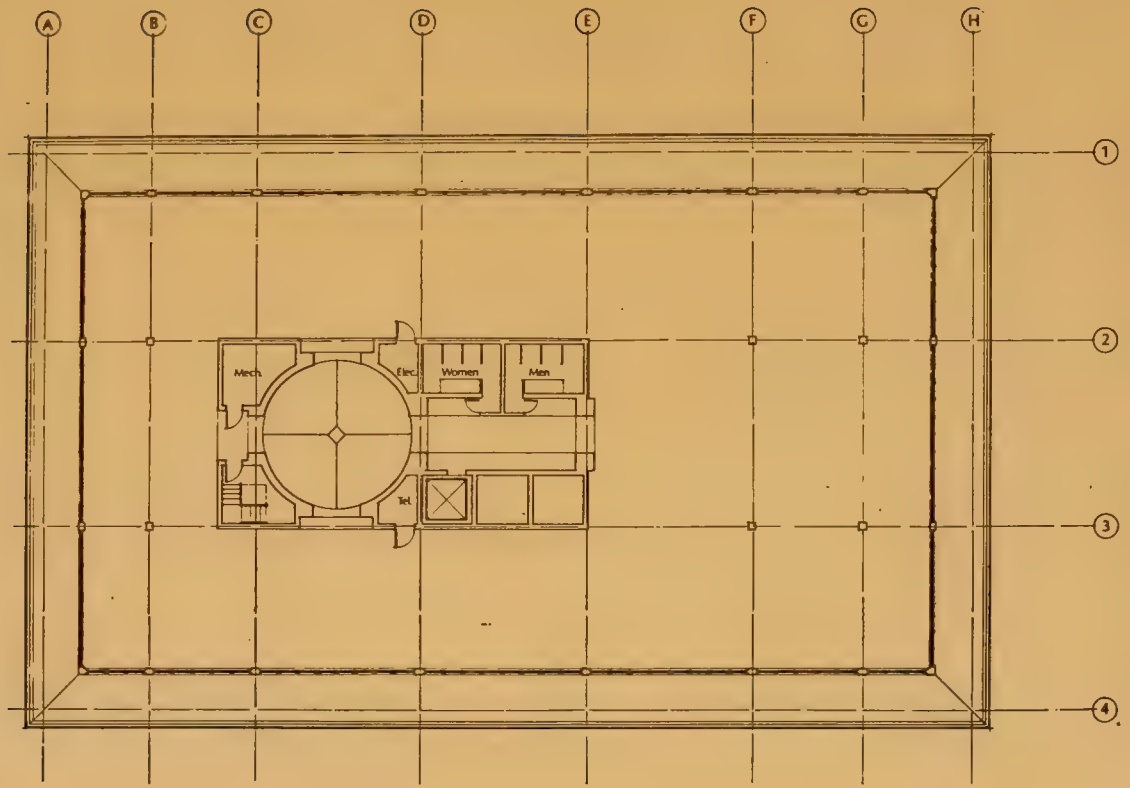
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By

Revised

Sht. No.

A7



SEVENTH FLOOR PLAN

DONNELLY MAUGEL ARCHITECTS

CYGNA CONSULTING ENGINEERS

JAMESTOWN PLACE, PARCEL 39A

Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust

Title

Date

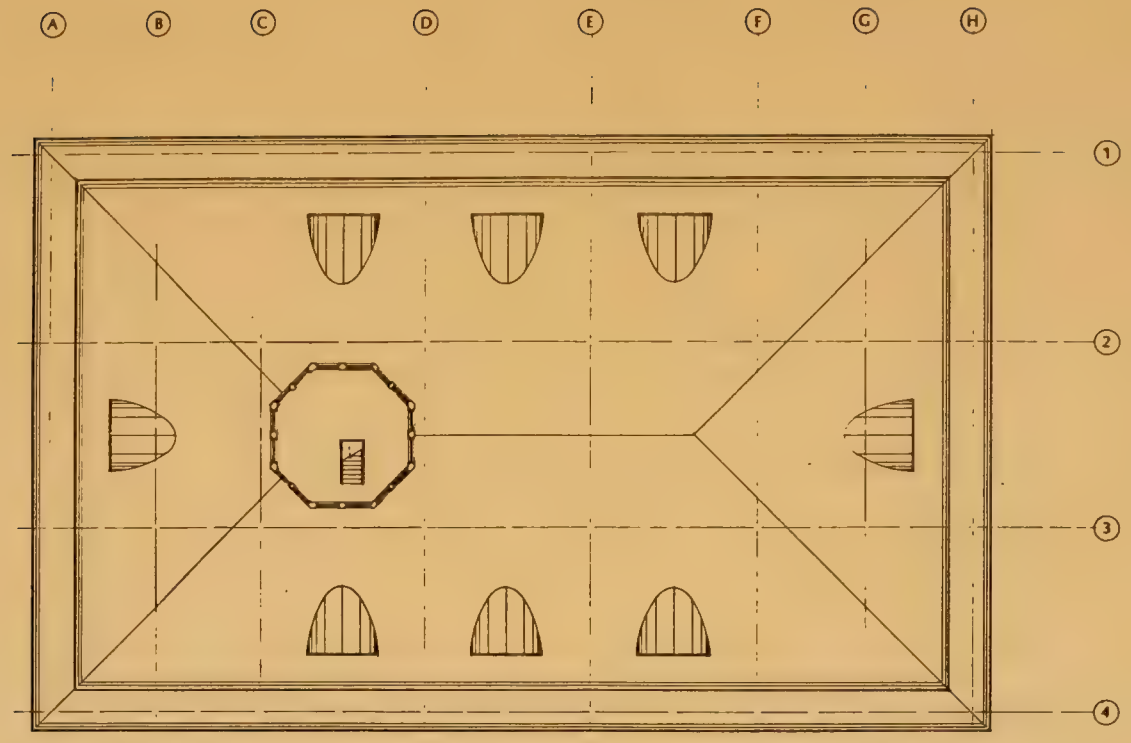
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By

Revised

Sht No.

A8



PENTHOUSE AND ROOF PLAN

DONNELLY MAUGEL ARCHITECTS

CYGNA CONSULTING ENGINEERS

JAMESTOWN PLACE, PARCEL 39A

Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust

Title

Date

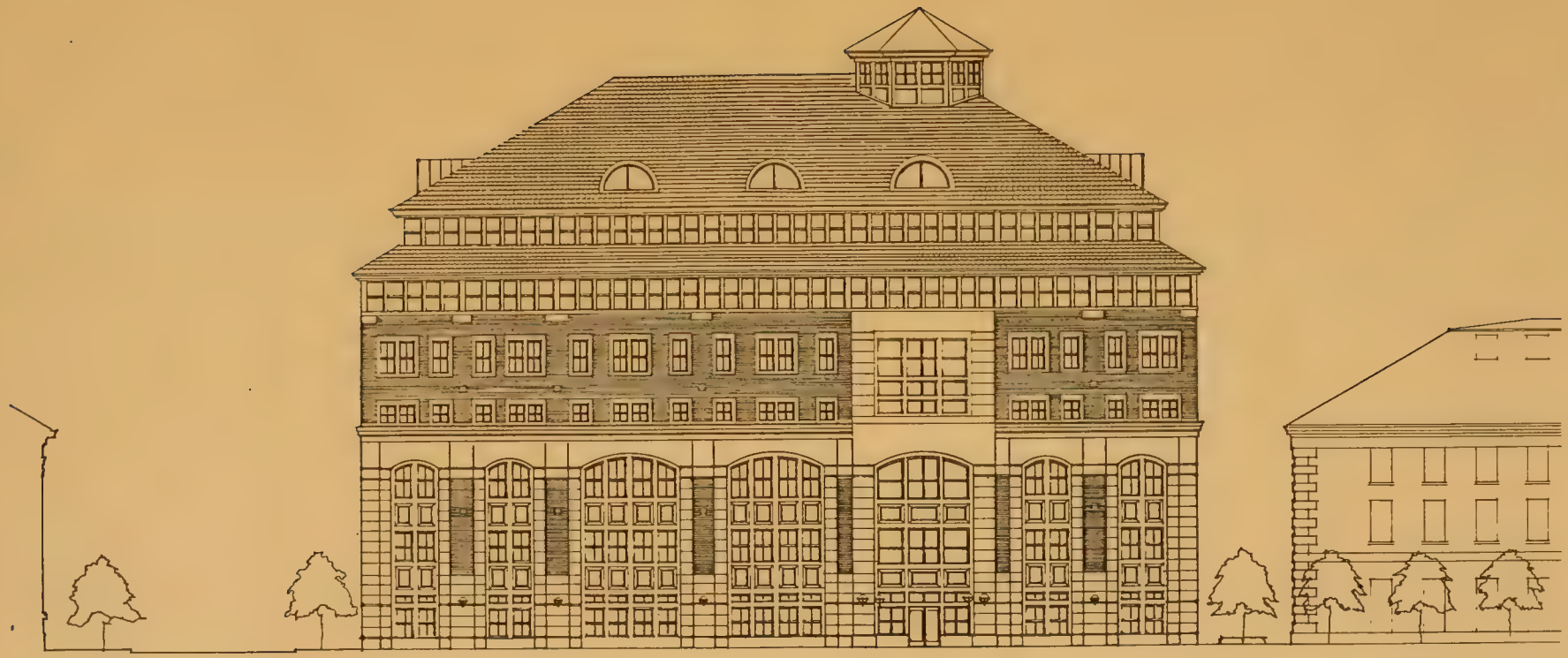
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Revised

Sht. No.

A9





SECOND AVENUE ELEVATION

DONNELLY MAUGEL ARCHITECTS

CYGNA CONSULTING ENGINEERS

JAMESTOWN PLACE, PARCEL 39A

Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust

Title SECOND AVE ELEVATION

Date

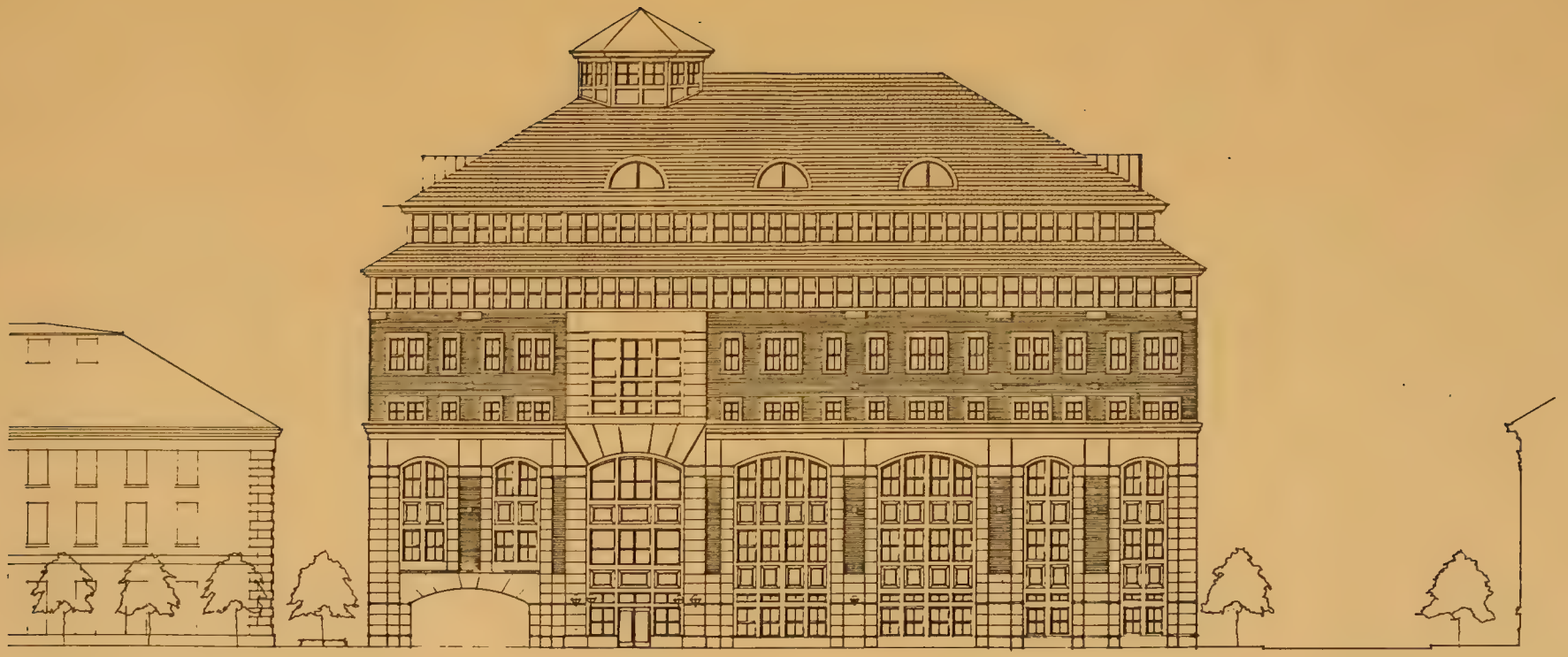
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By

Revised

Sht. No.

A10



FIRST AVENUE ELEVATION

DONNELLY MAUGEL ARCHITECTS

CYGNA CONSULTING ENGINEERS

JAMESTOWN PLACE, PARCEL 39A

Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust

Title

Date

Scale

By

Revised

Sht. No.

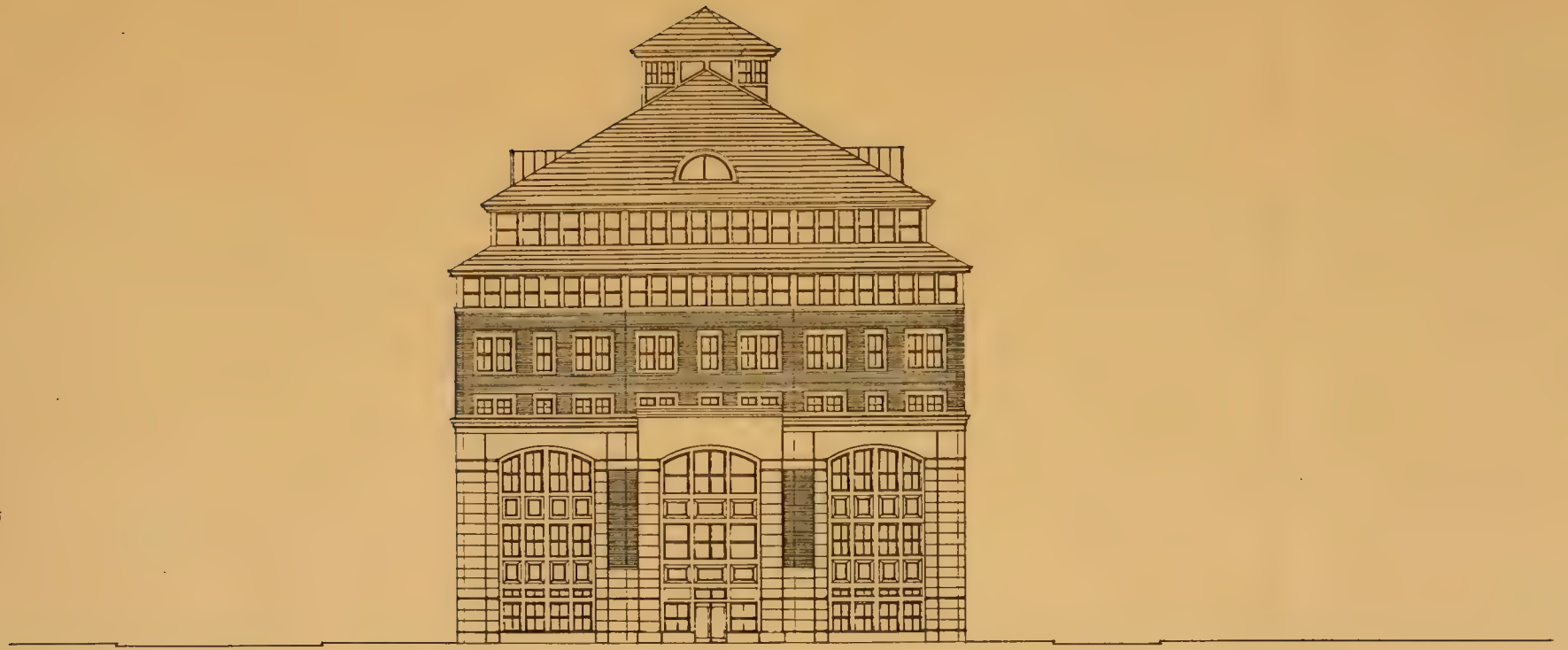
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DONNELLY MAUGEL ARCHITECTS

CYGNA CONSULTING ENGINEERS

JAMESTOWN PLACE, PARCEL 39A

Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust



NINTH STREET ELEVATION

Title

Date

Scale

By

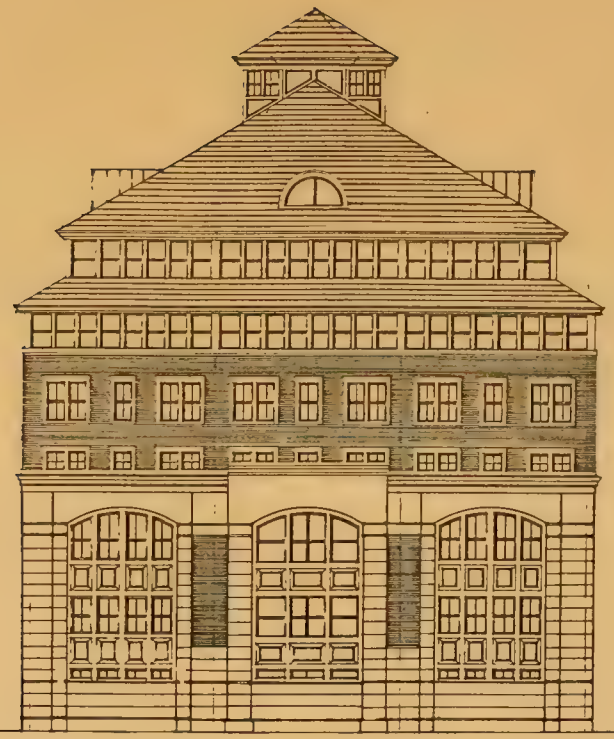
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Sht. No.

A12

DONNELLY
MAUGEL
ARCHITECTS

CYGNA
CONSULTING
ENGINEERS



JAMESTOWN PLACE, PARCEL 39A

Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust

WEST ELEVATION

Title

Date

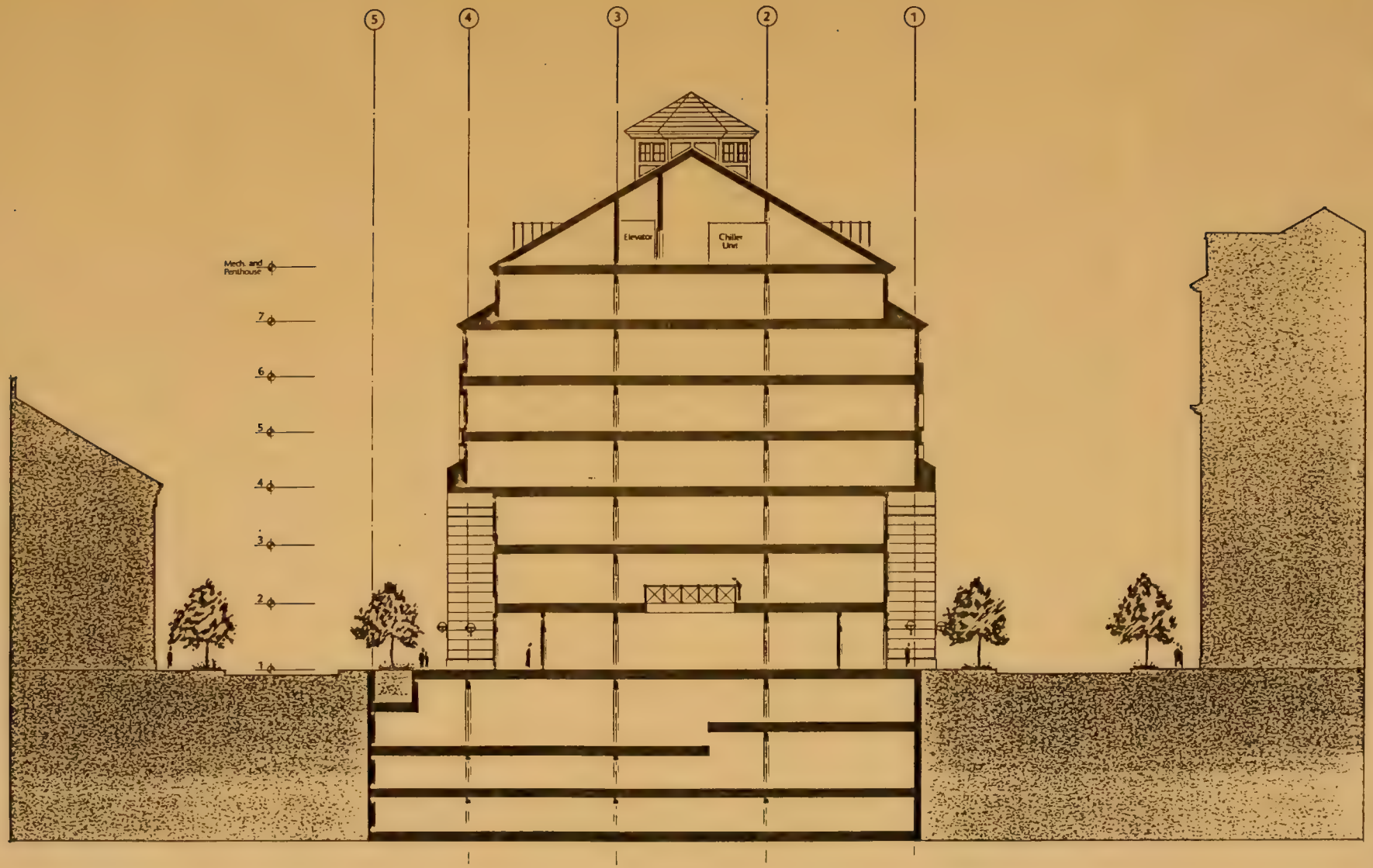
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Sht. No.

A13



S I T E S E C T I O N

DONNELLY MAUGEL ARCHITECTS

CYGNA CONSULTING ENGINEERS

JAMESTOWN PLACE, PARCEL 39A

Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust

Title

Date

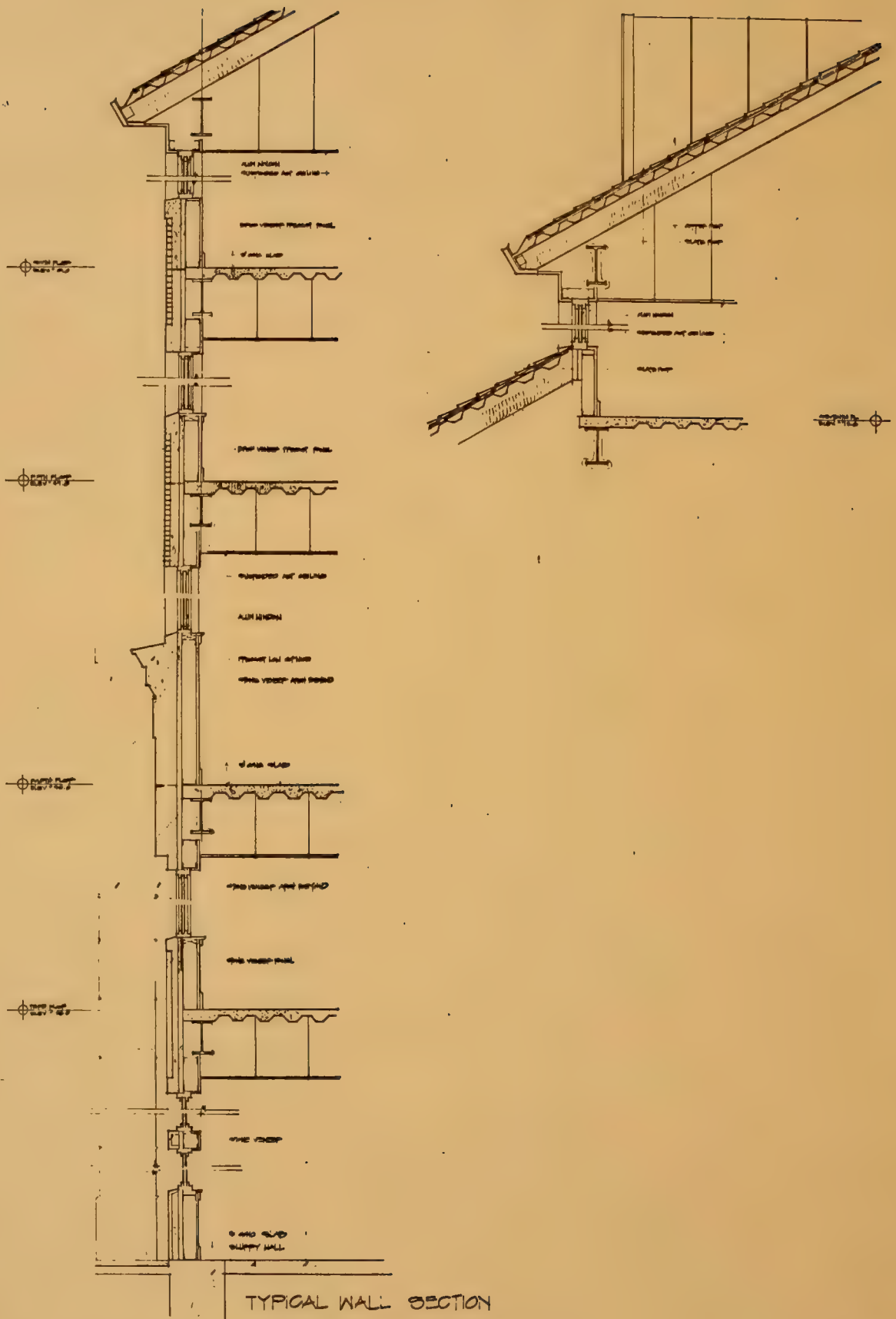
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Revised

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A14



TYPICAL WALL SECTION

Sht. No. A15

Title

Drawn

Scale

By

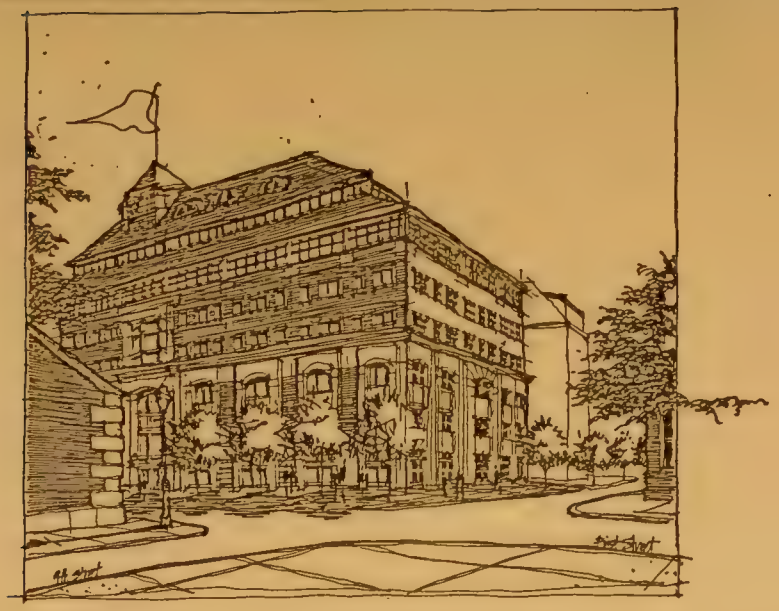
Revised

JAMESTOWN PLACE, PARCEL 39A

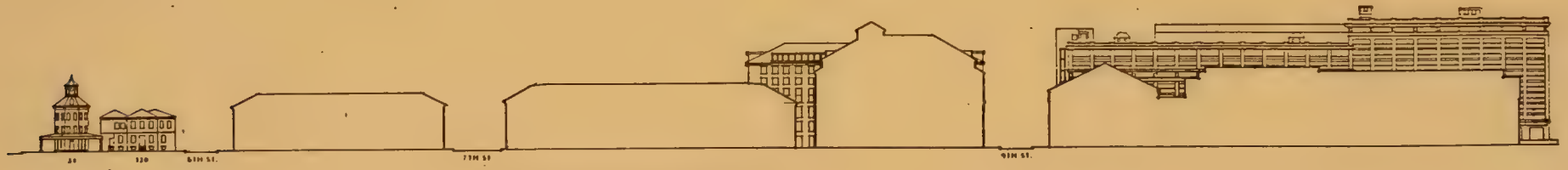
Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust

CYGNA CONSULTING ENGINEERS

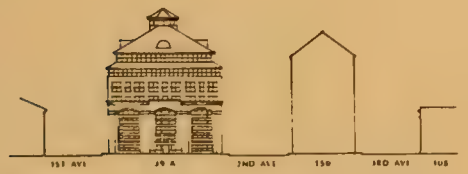
DONNELLY MAUGEL ARCHITECTS



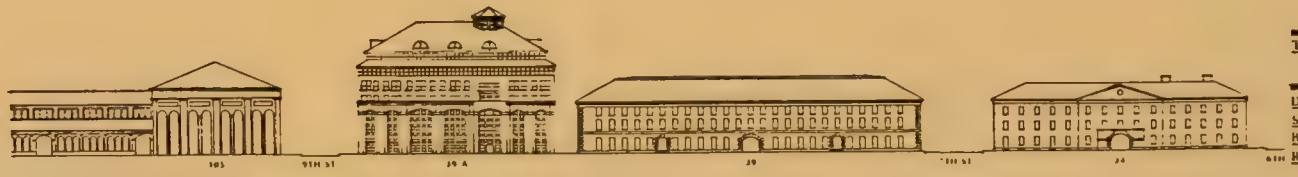
PERSPECTIVE



SECTION - SECOND AVENUE NORTH



ELEVATION - NINTH STREET WEST



ELEVATION - SECOND AVENUE SOUTH

DONNELLY MAUGEL ARCHITECTS

CYGNA CONSULTING ENGINEERS

JAMESTOWN PLACE, PARCEL 39A

Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust

Title

Date

Scale

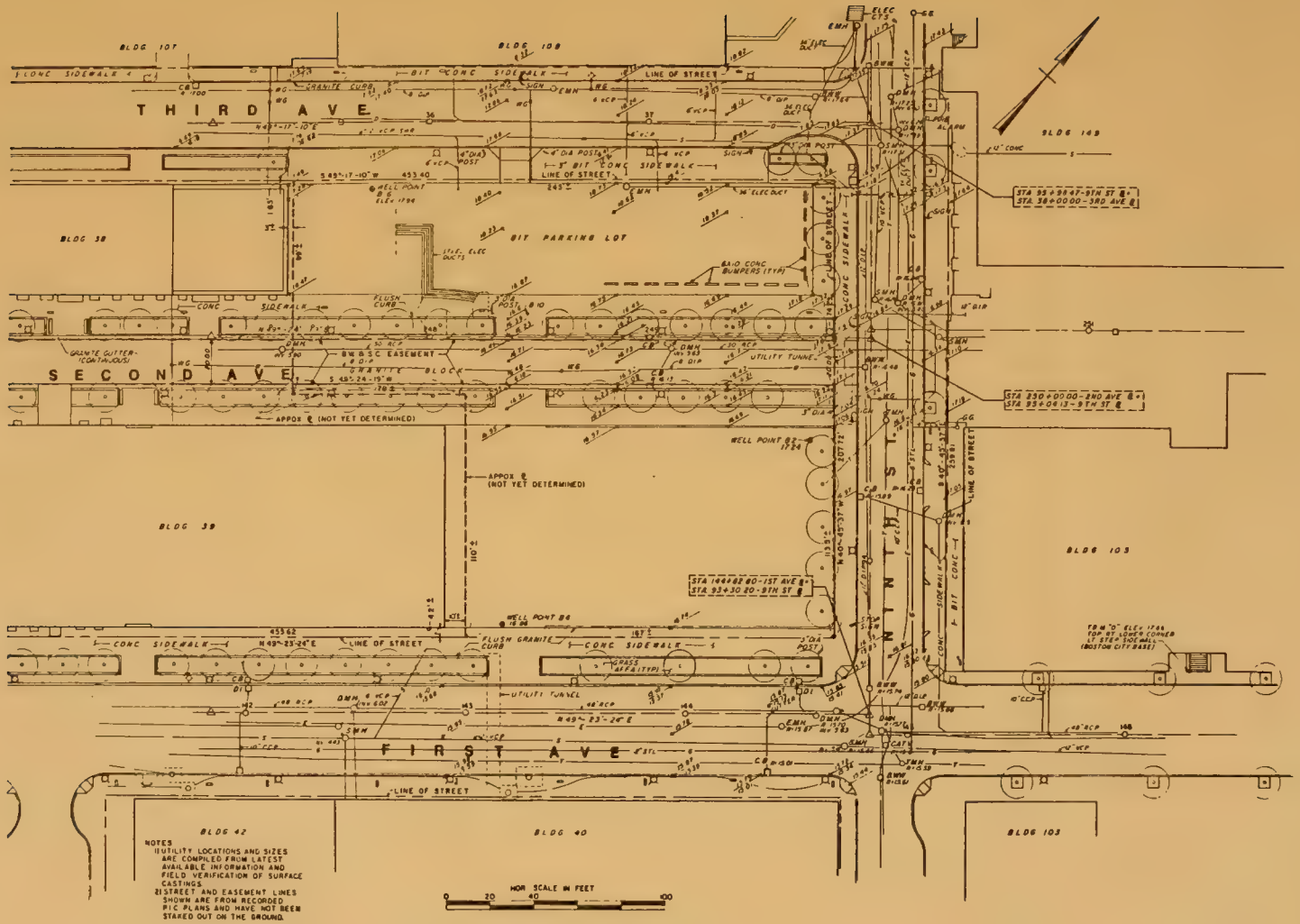
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Revised

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A16

2.0 Site and Utility Drawings



EXISTING SITE PLAN

DONNELLY MAUGEL ARCHITECTS

CYGNA CONSULTING ENGINEERS

JAMESTOWN PLACE, PARCEL 39A

Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust

Title

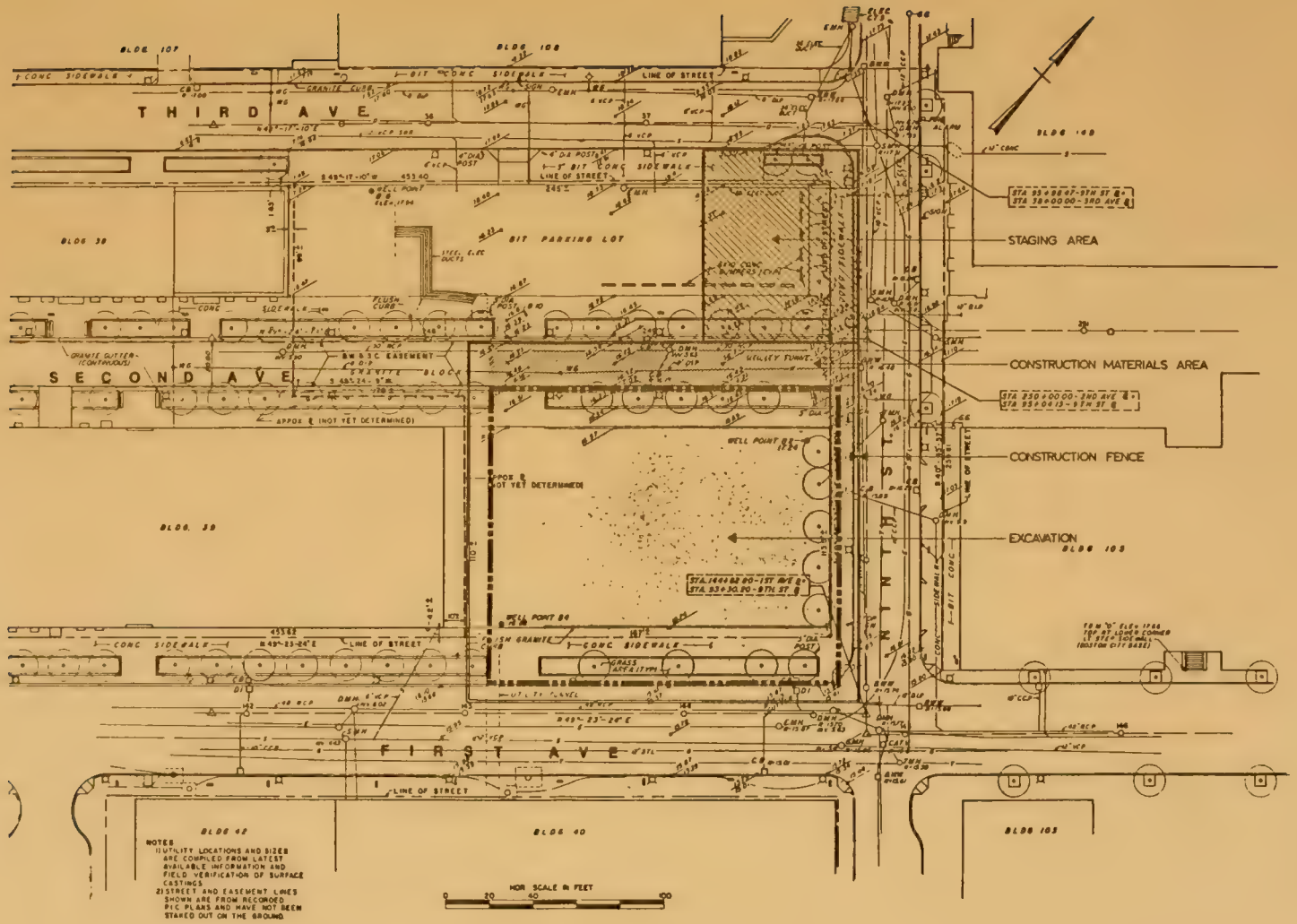
Date

Scale

By

Revised

Sht. No.



NOTES
1) UTILITY LOCATIONS AND SIZES ARE COMPILED FROM LATEST AVAILABLE INFORMATION AND FIELD VERIFICATION OF SURFACE FEATURES.
2) STREET AND EASEMENT LINES SHOWN ARE FROM RECORDED PLANS AND HAVE NOT BEEN STAKED OUT ON THE GROUND.

DEMOLITION PLAN

DONNELLY MAUGEL ARCHITECTS

CYGNA CONSULTING ENGINEERS

JAMESTOWN PLACE, PARCEL 39A

Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust

Title

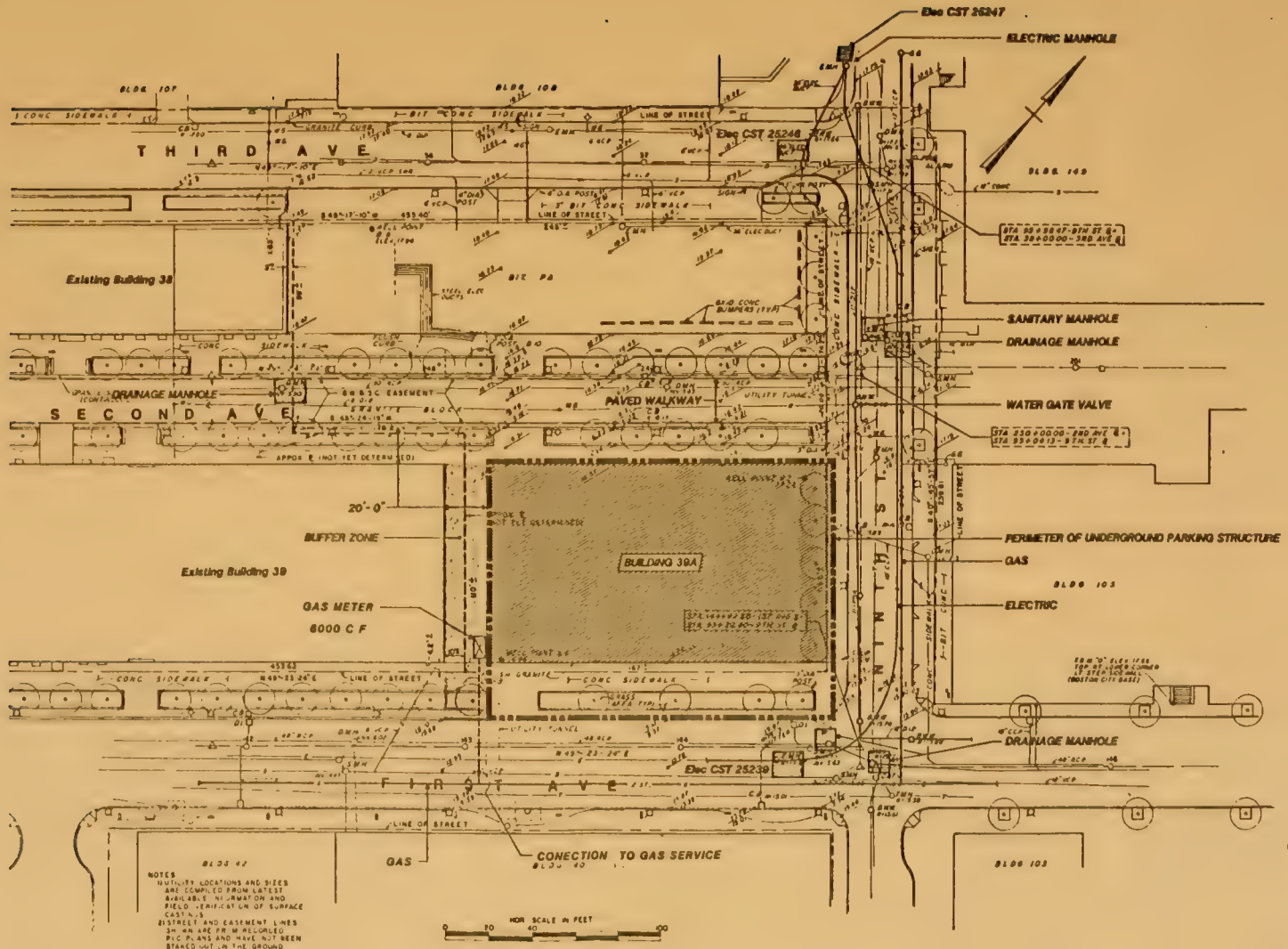
Date

Scale

By

Revised

Sht No



BUILDING LOCATION PLAN

DONNELLY MAUGEL ARCHITECTS

CYGNA CONSULTING ENGINEERS

JAMESTOWN PLACE, PARCEL 39A

Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust

Title

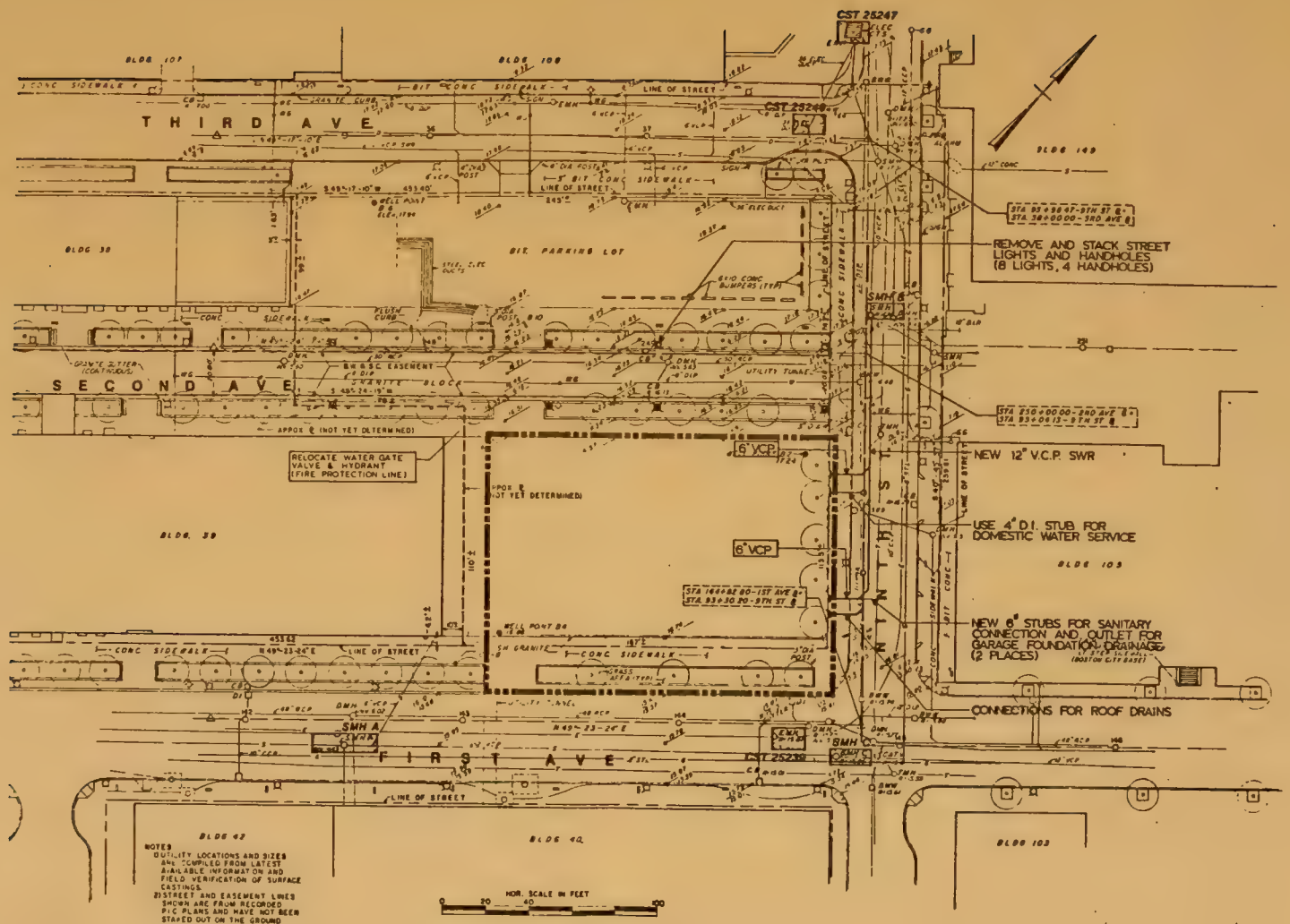
Date

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Sht. No.



UTILITY LOCATION PLAN

DONNELLY MAUGEL ARCHITECTS

CYGNA CONSULTING ENGINEERS

JAMESTOWN PLACE, PARCEL 39A

Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust

Title:

Date:

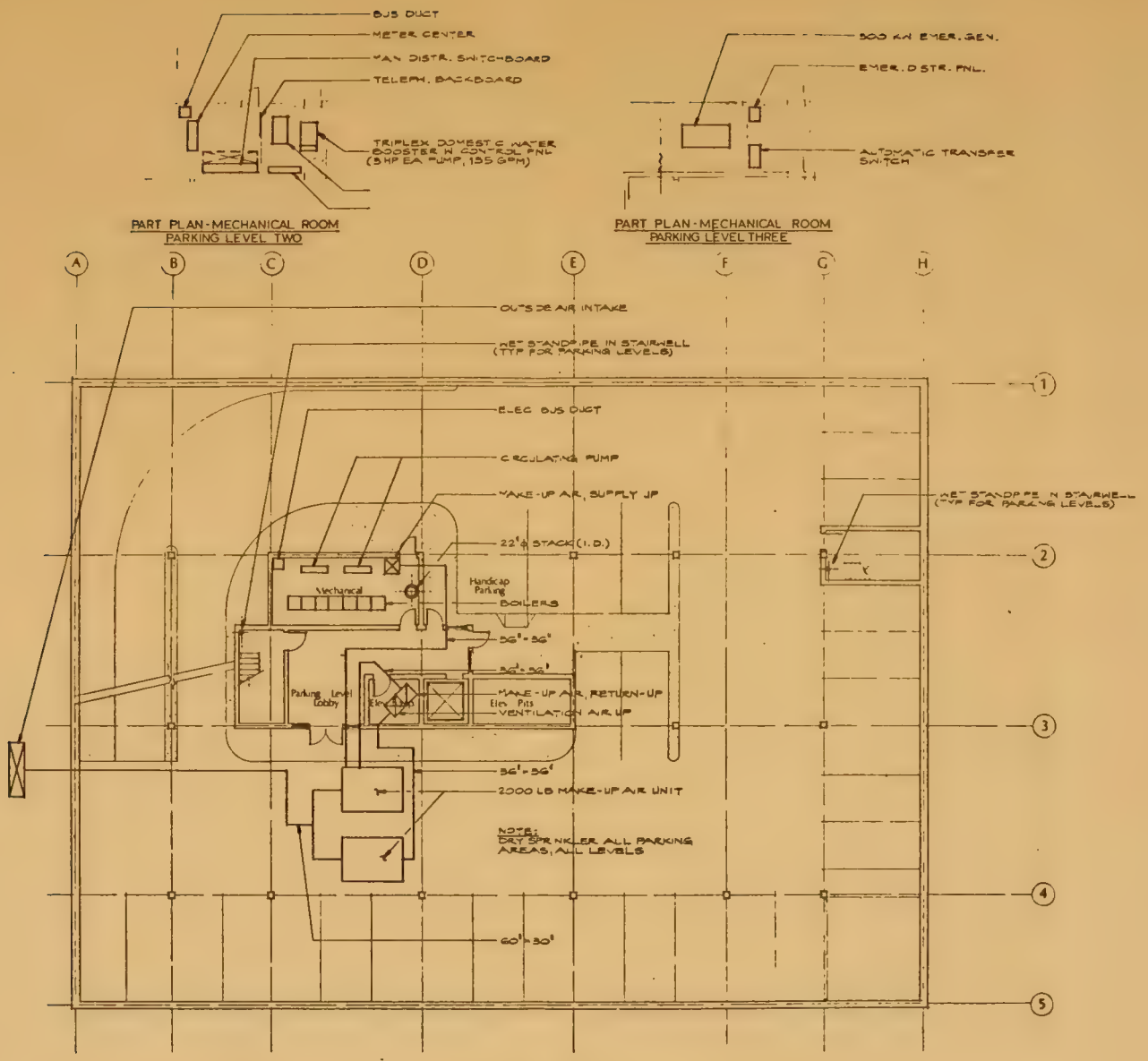
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Sht. No.

3.0 Building Environmental System Drawings



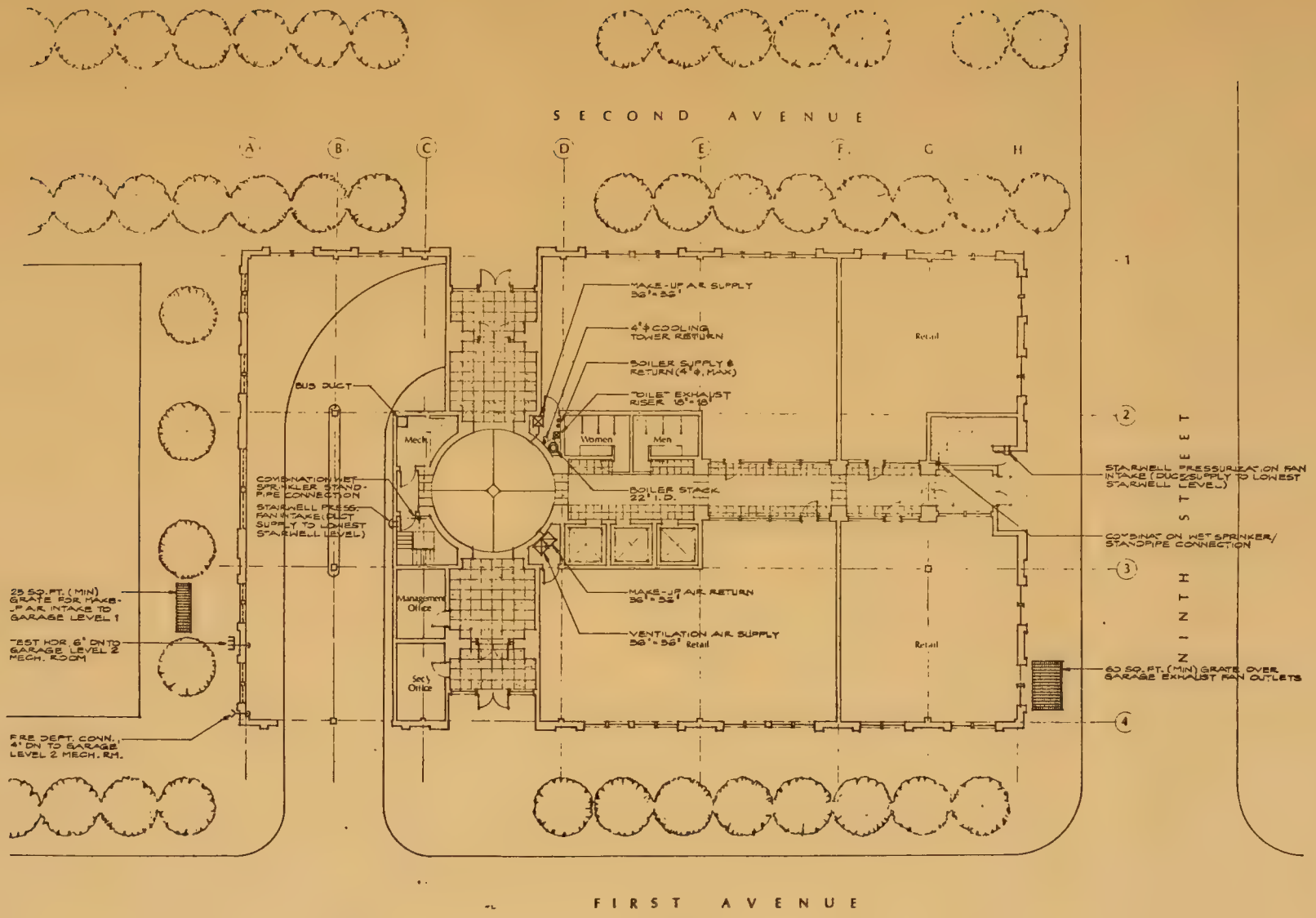
PARKING LEVEL ONE
BUILDING SYSTEMS

DONNELLY MAUGEL ARCHITECTS
Cambridge House, 20 Sanborn Street, Boston, Massachusetts 02116 617-262-2220

CYGNA CONSULTING ENGINEERS
29th CONGRESS STREET BOSTON, MA 02210

JAMESTOWN PLACE, PARCEL 39A
Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust

Title:
Date:
Scale:
By:
Revised:
Sht. No.



FIRST FLOOR PLAN
BUILDING SYSTEMS

DONNELLY MAUGEL ARCHITECTS

CYGNA CONSULTING ENGINEERS
296 CONGRESS STREET BOSTON, MA 02210

JAMESTOWN PLACE, PARCEL 39A
Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust

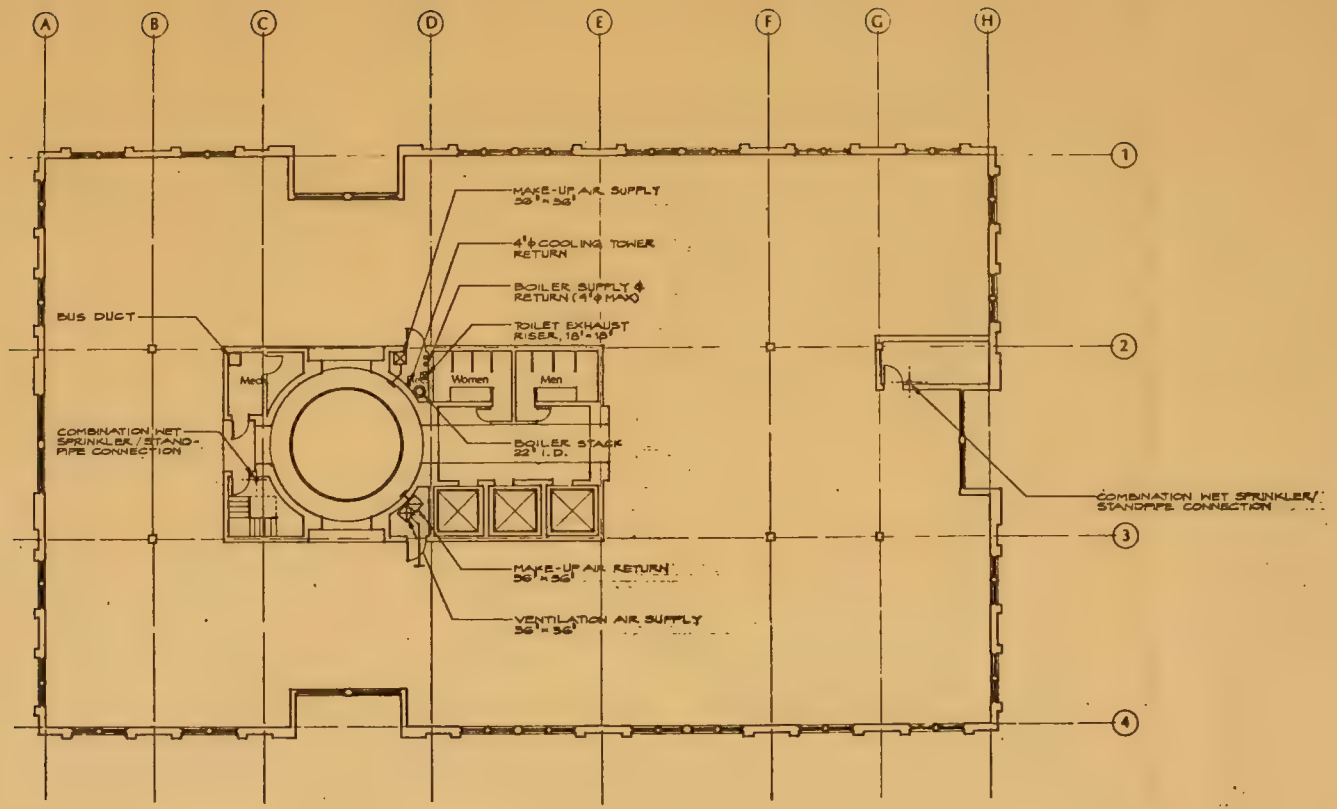
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Sht. No.

DONNELLY MAUGEL ARCHITECTS

CYGNA CONSULTING ENGINEERS



JAMESTOWN PLACE, PARCEL 39A

Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust

SECOND FLOOR PLAN
BUILDING SYSTEMS

Title:

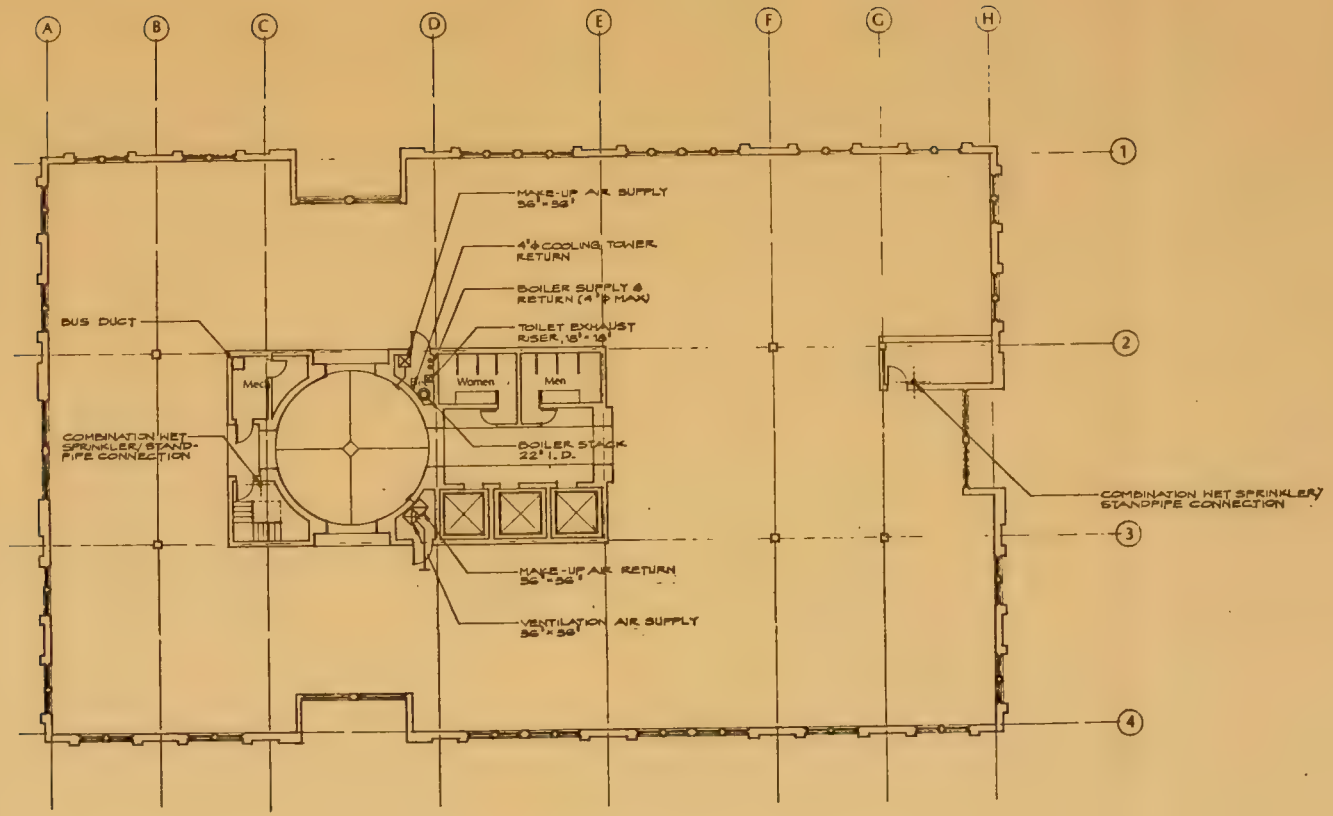
Date:

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THIRD FLOOR PLAN
BUILDING SYSTEMS

DONNELLY MAUGEL ARCHITECTS

CYGNA CONSULTING ENGINEERS

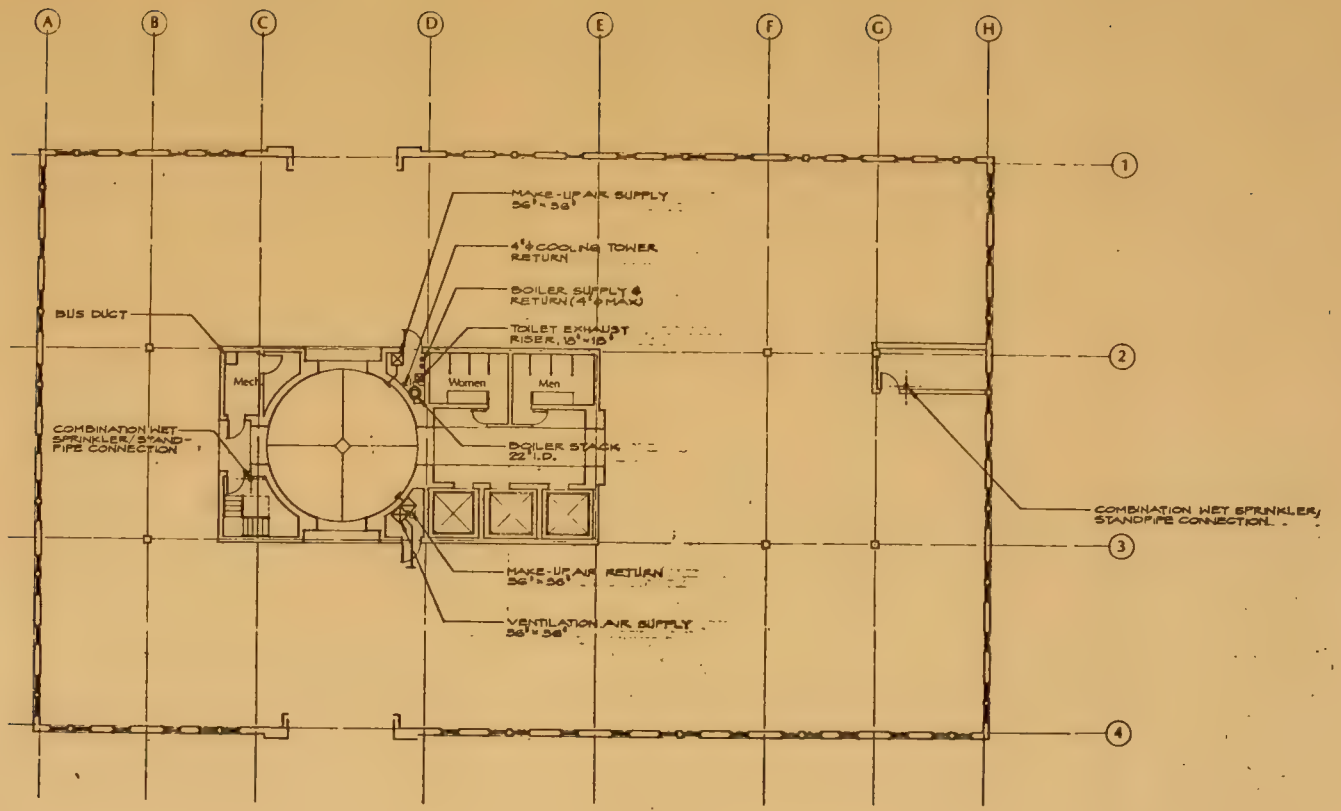
JAMESTOWN PLACE, PARCEL 39A

Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust

Title:

Date:
Scale:
By:
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Sht. No.



4TH & 5TH FLOOR PLAN
BUILDING SYSTEMS

DONNELLY MAUGEL ARCHITECTS

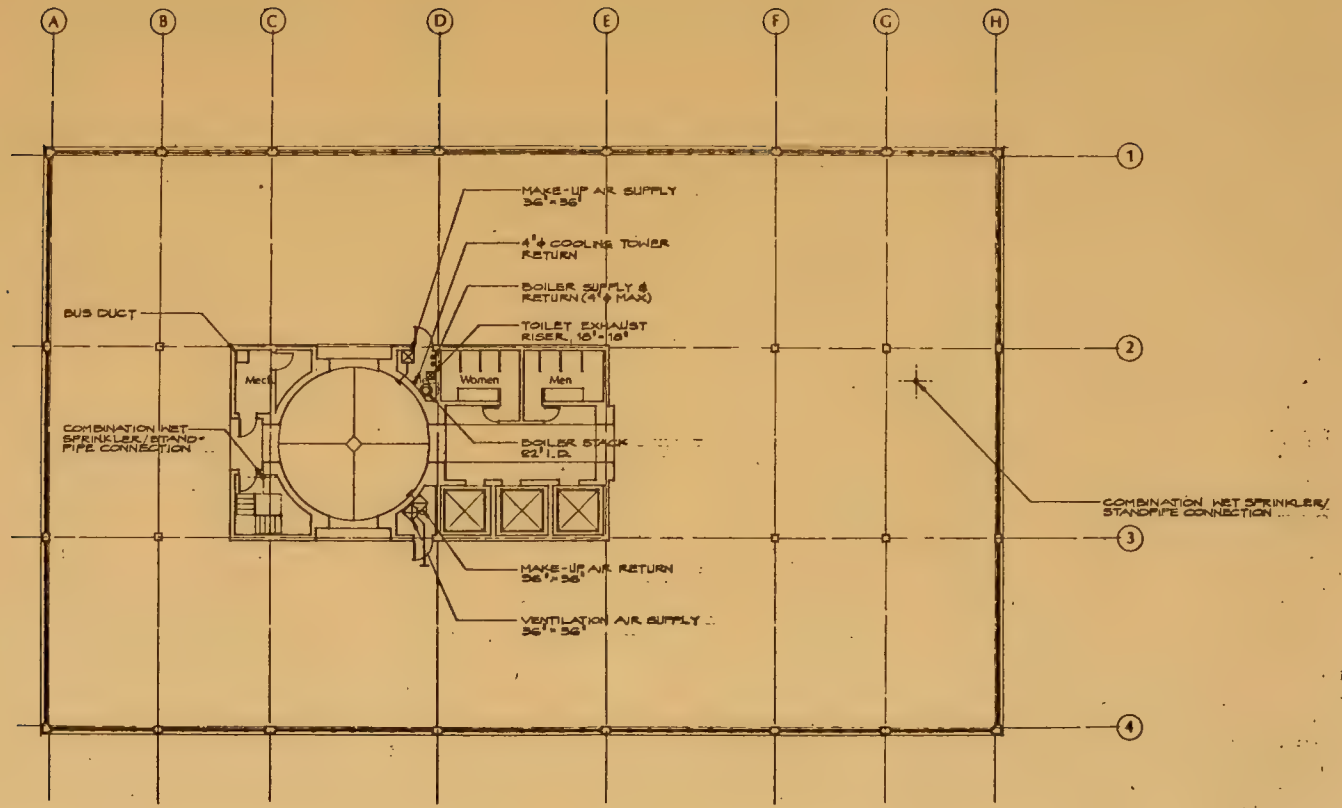
CYGNA CONSULTING ENGINEERS

JAMESTOWN PLACE, PARCEL 39A
Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust

Title:

Date:
Scale:
By:
Revised:

Sht. No.



SIXTH FLOOR PLAN
BUILDING SYSTEMS

DONNELLY MAUGEL ARCHITECTS

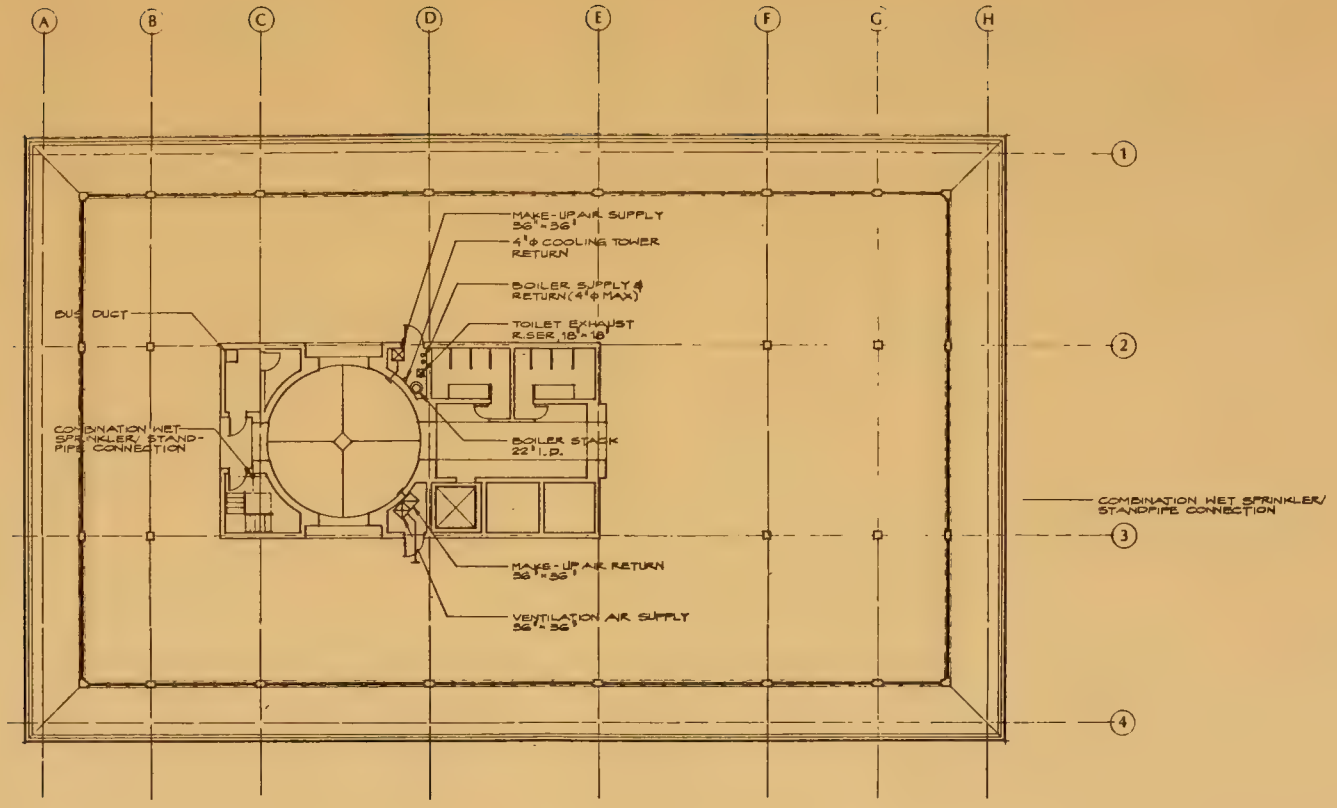
CYGNA CONSULTING ENGINEERS

JAMESTOWN PLACE, PARCEL 39A
Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust

Title:

Date:
Scale:
By:
Revised:

Sht. No.



SEVENTH FLOOR PLAN
BUILDING SYSTEMS

DONNELLY MAUGH ARCHITECTS

CYGNA CONSULTING ENGINEERS

JAMESTOWN PLACE, PARCEL 39A

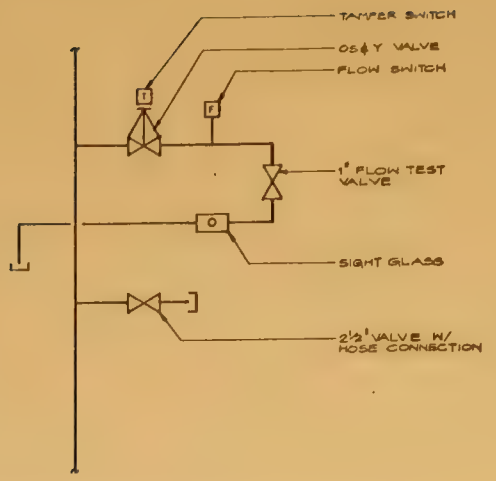
Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust

Title:

Date:
Scale:
By:
Revised:

Sht. No.





COMBINATION WET SPRINKLER/STANDPIPE CONNECTION DETAIL
NTS

SEWAGE AND WATER FLOW ESTIMATE
SEWAGE 75 GALS PER DAY PER 1000 S.F. = 7500 GALS PER DAY
WATER ½ OF SEWAGE FLOW = 3750 GALS PER DAY
NOTE: ESTIMATES COMPILED FROM STATE ENVIRONMENTAL CODE, TITLE 5

GAS LOAD SUMMARY	
HEATING	
HOT WATER	250 CFH
COOKING	
MISC	
TOTAL	
NOTE: ESTIMATE BASED ON 1000 BTU PER CUBIC FOOT	

BUILDING SYSTEMS

DONNELLY MAUGEL ARCHITECTS

CYGNA CONSULTING ENGINEERS
[illegible] CONGRESS STREET
BOSTON, MA 02210

JAMESTOWN PLACE, PARCEL 39A

Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust

Title:

Date:
Scale:
By:
Revised:

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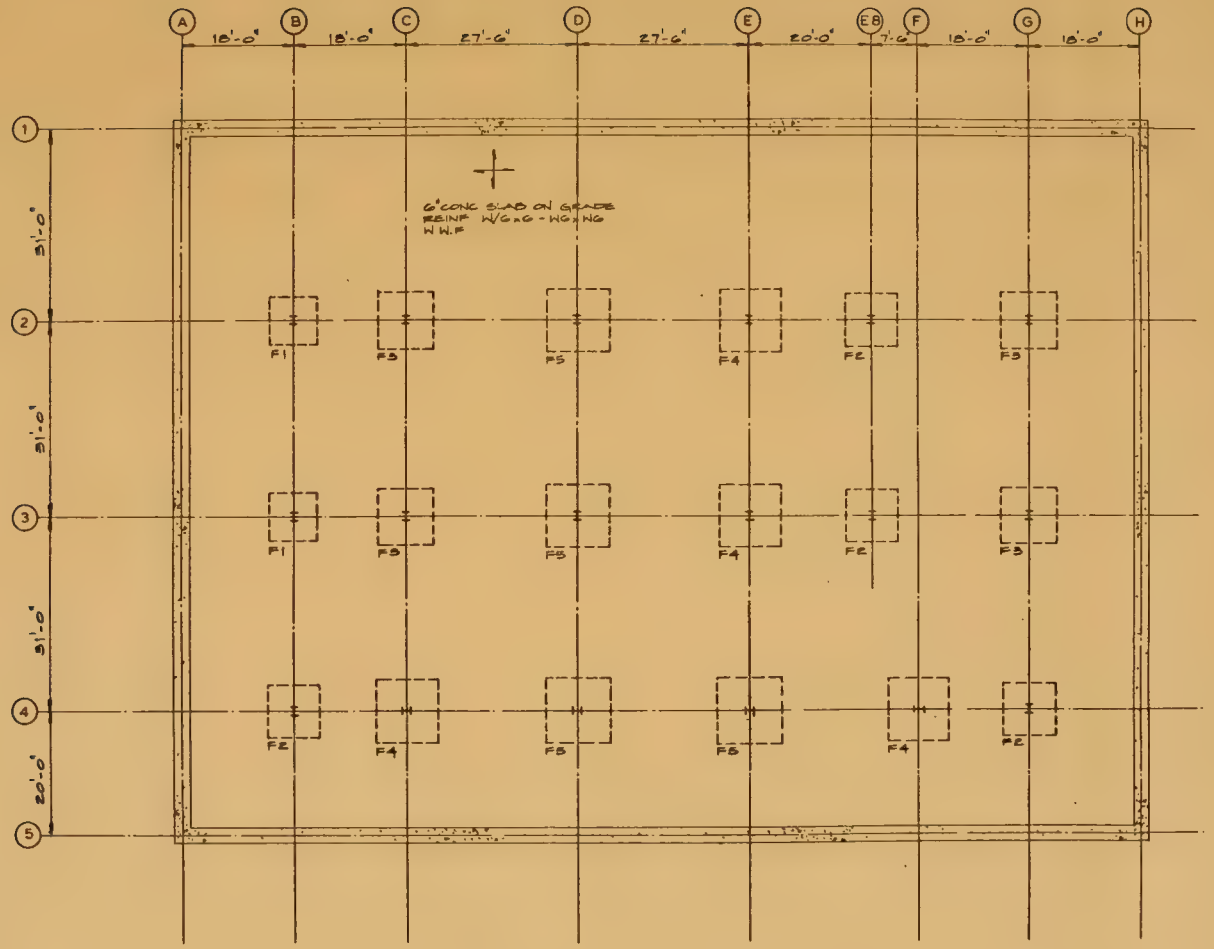
4.0 Structural System Design

DONNELLY MAUGEL ARCHITECTS

CYGNA CONSULTING ENGINEERS

JAMESTOWN PLACE, PARCEL 39A

Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust



BASEMENT PLAN

FOOTING SCHEDULE

MARK	SIZE	REINFORCEMENT
F1	7'-0" x 7'-0" x 2'-3"	8-#7 B.E.W.
F2	8'-6" x 8'-6" x 2'-6"	10-#7 B.E.W.
F3	8'-0" x 8'-0" x 2'-6"	10-#7 B.E.W.
F4	10'-0" x 10'-0" x 2'-9"	10-#8 B.E.W.
F5	10'-6" x 10'-6" x 2'-9"	10-#8 B.E.W.

Title

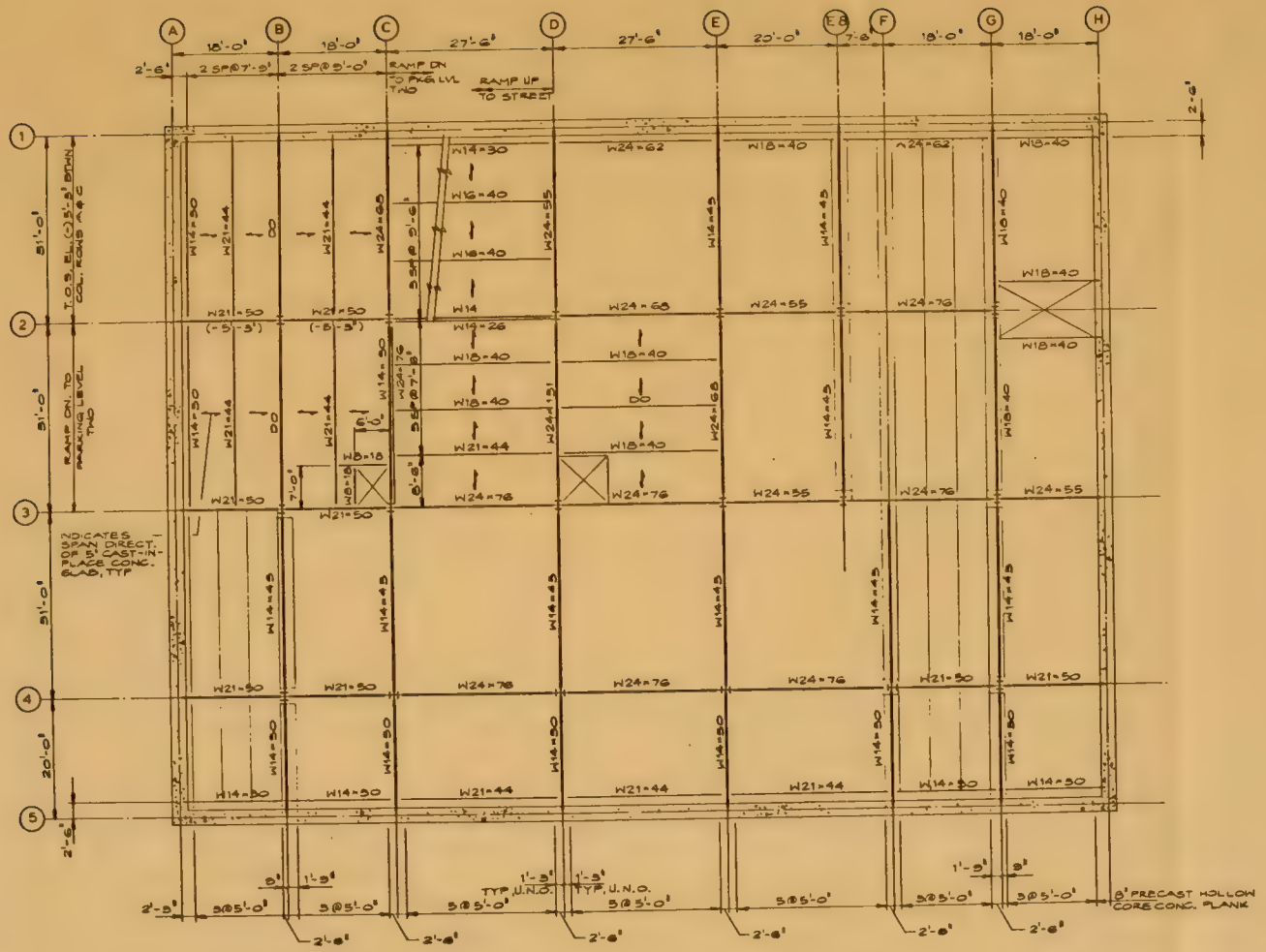
Date

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PARKING LEVEL ONE
FRAMING PLAN

DONNELLY MAUGEL ARCHITECTS

CYGNA CONSULTING ENGINEERS

JAMESTOWN PLACE, PARCEL 39A

Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust

Title

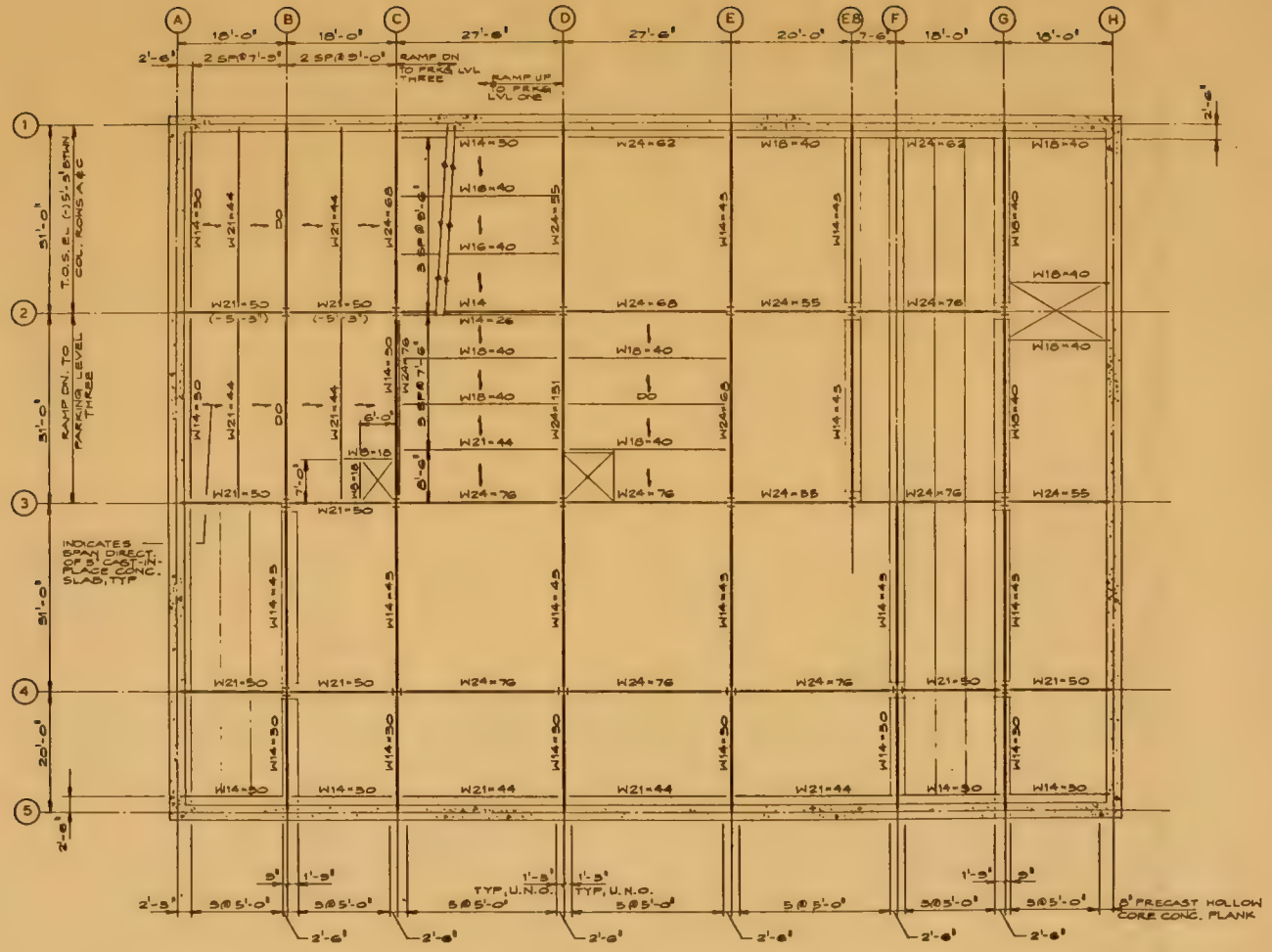
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CYGNA CONSULTING ENGINEERS

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Charlestown Navy Yard Boston, Massachusetts Jamestown Place Realty Trust

Title

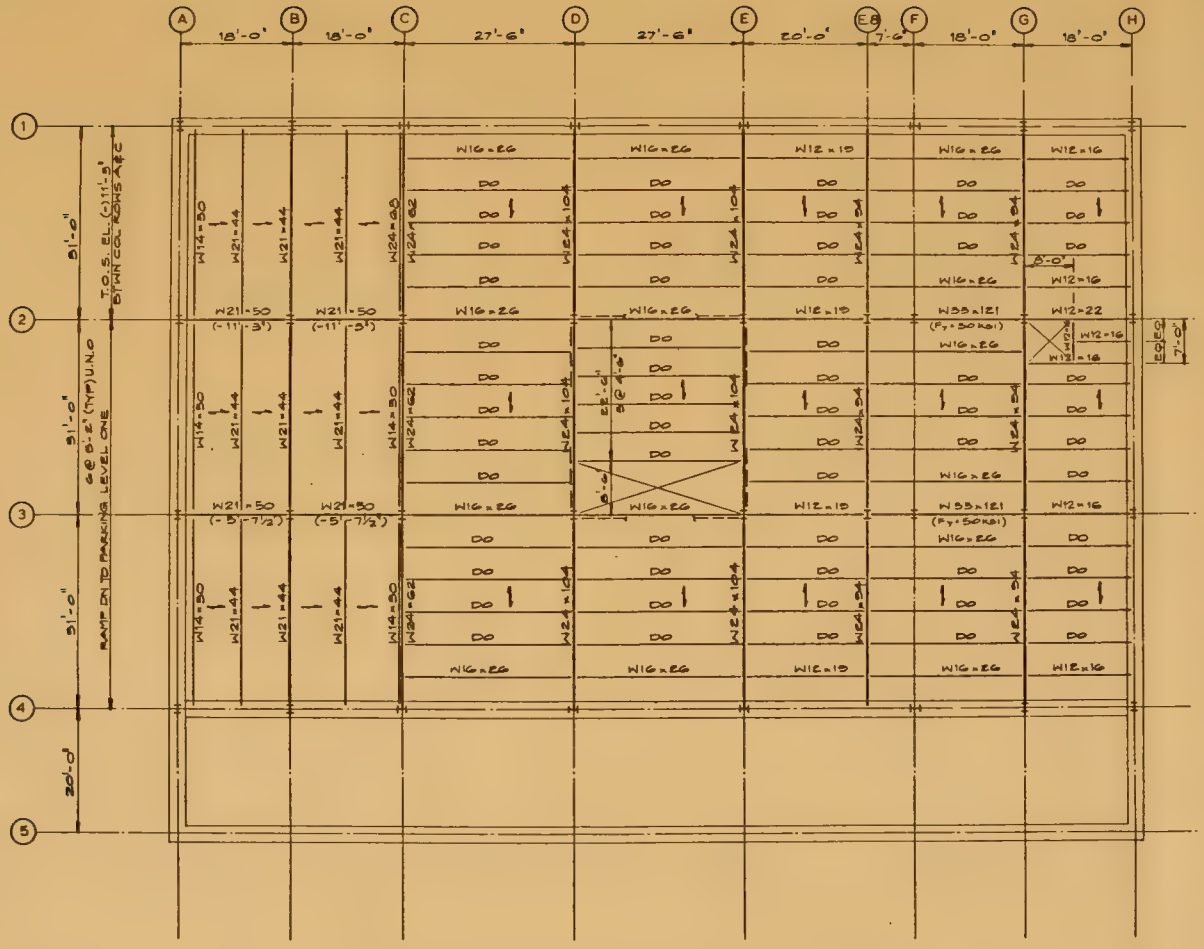
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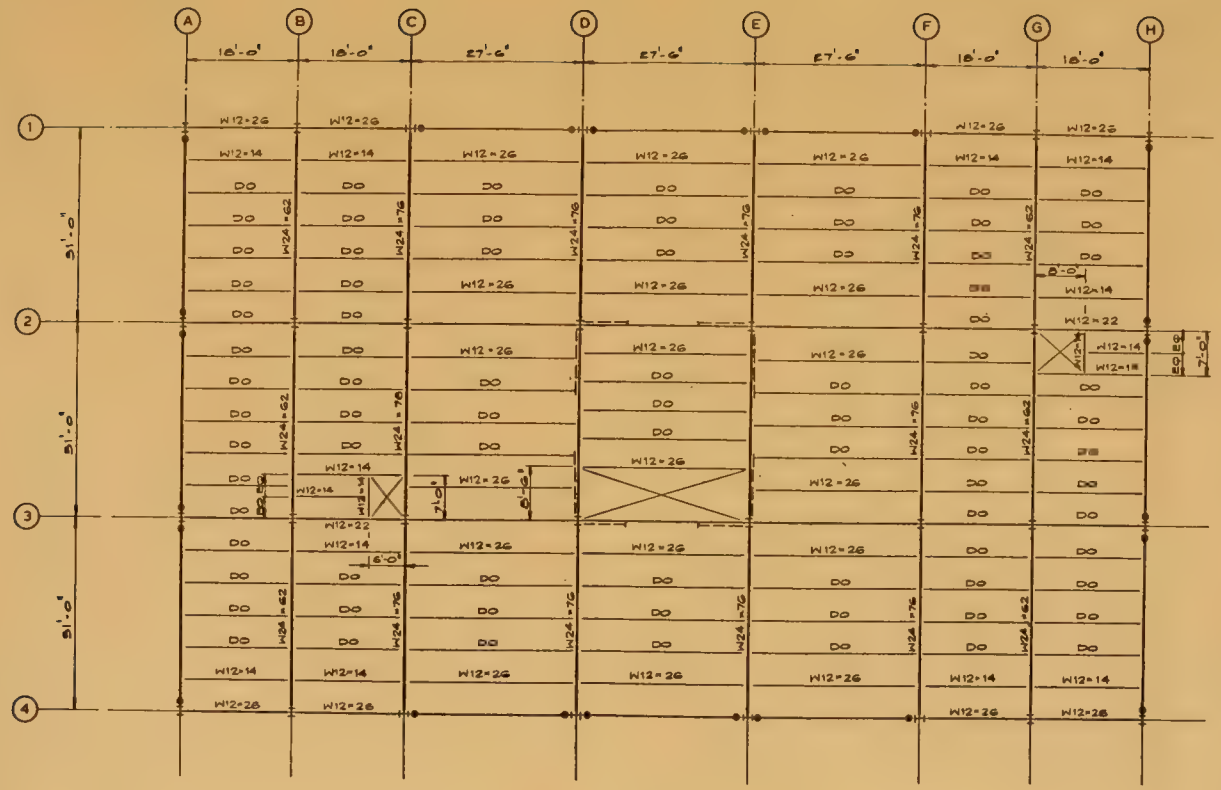
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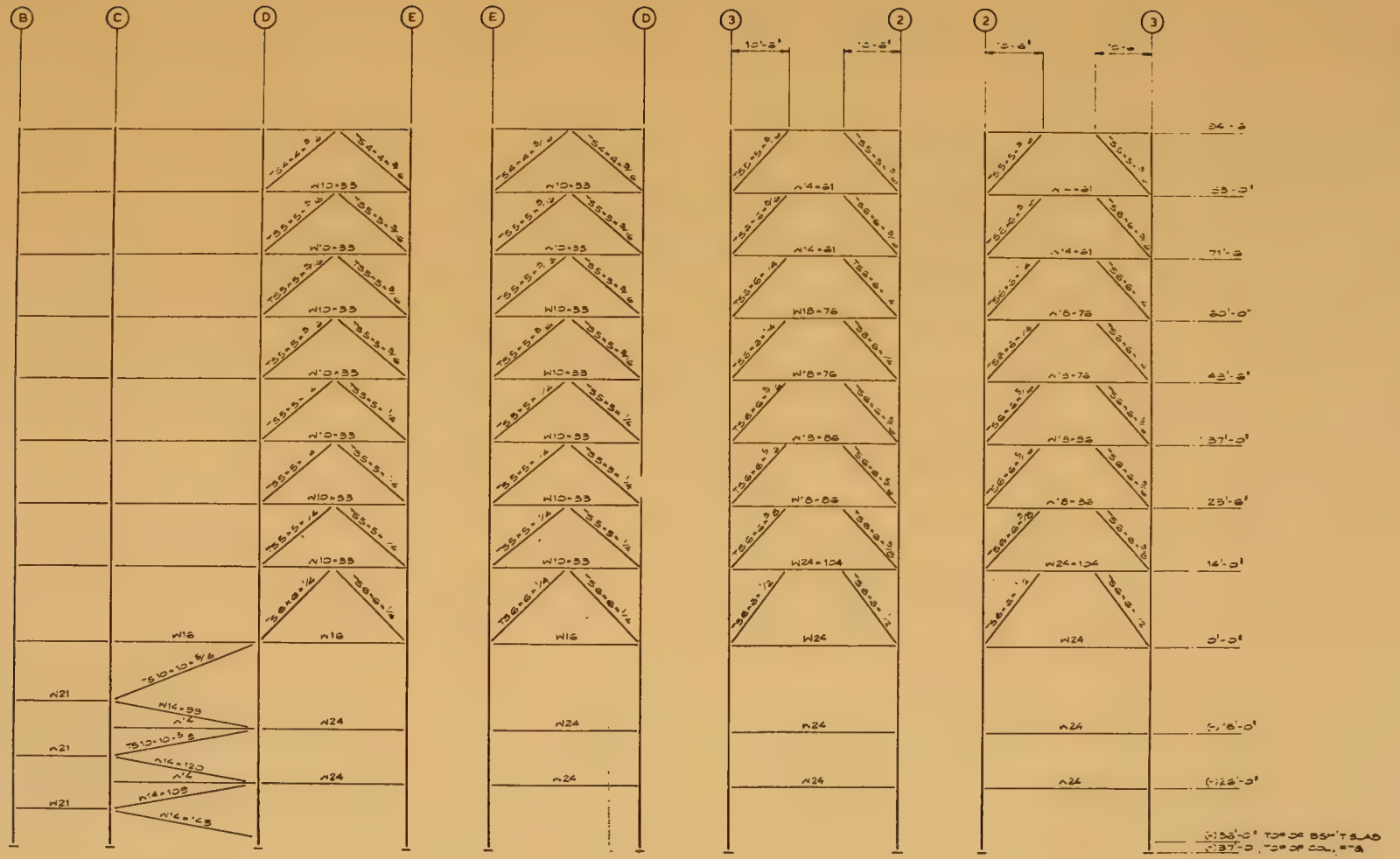
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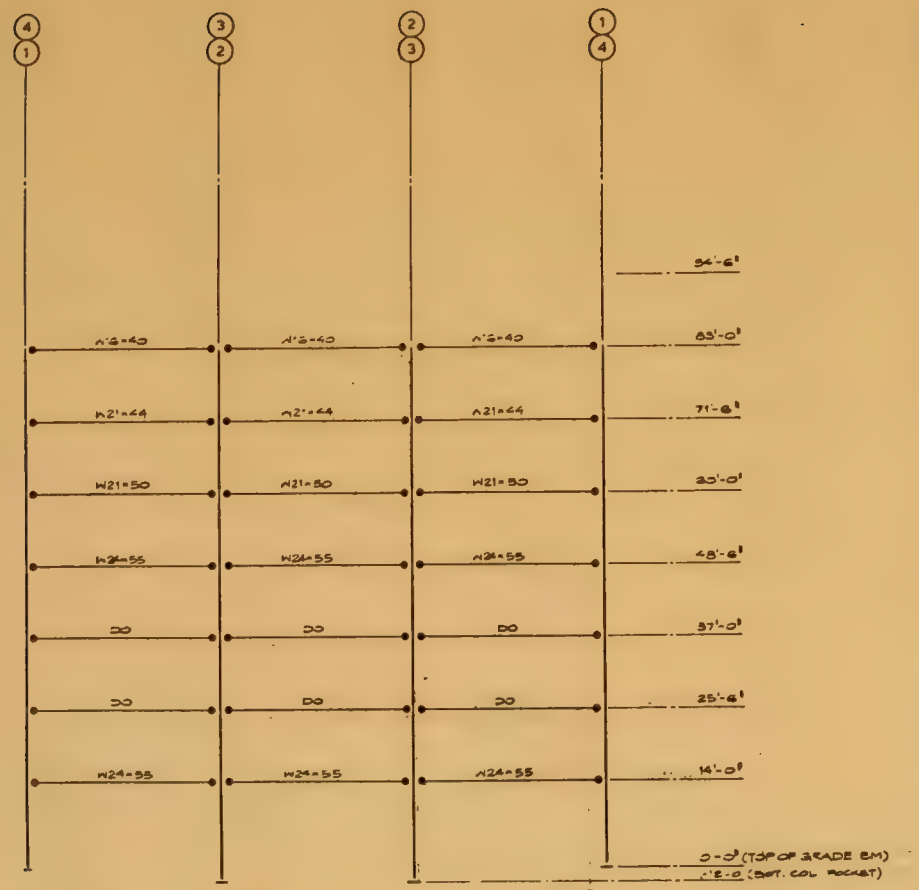
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DONNELLY MAUGEL ARCHITECTS

CYGNA CONSULTING ENGINEERS
29th CONGRESS STREET
BOSTON, MA 02210



MOMENT FRAME ELEVATION
EAST & WEST EXTERIOR WALLS



MOMENT FRAME ELEVATION
NORTH & SOUTH EXTERIOR WALLS

JAMESTOWN PLACE, PARCEL 39A

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